

FINAL REPORT

ADMINISTRATIVE STUDY

The effect of 2,4-D on sagebrush and associated vegetation on
the Beaverhead National Forest, Montana

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A Cooperative study between
the U. S. Forest Service
and
the Montana Agricultural Experiment Station

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ROCKY MOUNTAIN STATION

ERRATA

Table 1. Balsamorhiza sigattata is
B. sagittata.

Appendix:

Badger Pass Site No. 2: "unsprayed" picture
is upside down.

Middle Creek Site No. 1: Heading page -
change sampling dates to July 31-Aug. 3.

North Saddle Site No. 2: The "unsprayed"
and "sprayed" pictures are reversed.

General Notes:

1. "Dolittle" should be "Doolittle".
2. Bromus pumpellianus should be Bromus inermis ssp. pumpellianus.
3. Bar graphs in the Appendix each have a pair of bars labeled "Big and three-tipped sagebrush". The data in the accompanying tables will show which sagebrush species is present in a particular site.

INTRODUCTION

This report presents the final results of a three-year cooperative study funded by the Beaverhead National Forest and Montana Agricultural Experiment Station. The study was designed primarily to determine the effects of chemical sagebrush control on the associated forb vegetation. Supplemental information included the responses of shrubs, particularly sagebrush, and grasses to spraying.

Additional information became available through analyses of the data obtained in this project. Even though this information does not relate to the objectives of the study, most of it is included in the report. Some of it likely will be of interest to resource managers.

The report is organized into two major units. The first unit discusses methodology, provides an overall summary of the data and evaluates results. The second unit, the appendix, provides data summaries and graphs by site for those who desire more detailed information.

ACKNOWLEDGEMENTS

This study succeeded because of the excellent cooperation of a number of people. W. B. Gallagher, Supervisor, Beaverhead National Forest initiated the study and provided administrative and financial support. This was continued by his successor, Charles Hartgraves.

Donald Nelson, Range and Wildlife Staff Officer, Beaverhead N. F., gave liberally of his time, both in the field and in the administration of the field personnel. A number of other people in the Supervisor's Office, Dillon, cheerfully helped with routine needs of the study. District personnel also were most cooperative in providing information, maps and, in a few cases, field help.

Central to the accomplishment of the study were the field crews. Ausra Rudvallis West worked on the study all three summers, providing much needed continuity in data acquisition. Working with her were Elvira Cosgriff Hahn the first summer, Cecile Bythewood the second summer, and Patty Nicholas Trautman the third summer.

The Montana Agricultural Experiment Station provided the Principal Investigator (author of this report), office facilities and secretarial time. The management of the scientific aspects of the study and the contents and interpretations in this report are the sole responsibility of the author.

METHODS

Sampling site selection:

The primary approach to this study was to analyze the vegetational cover of sites on which both unsprayed and sprayed vegetation occurred. Nearly all sagebrush control projects on the Beaverhead National Forest which were completed between 1959 and 1969, inclusive, were examined for potential study sites. Fourteen study sites were located on 9 sagebrush control projects. Data from these sites provided an assessment of long-term effects of sagebrush control with 2,4-D.

In addition, several sites were located on proposed 1970 sagebrush control projects at which 300 ft. x 600 ft. blocks were established to be left unsprayed. The vegetation of each of these blocks was analyzed before spraying took place in the adjacent rangeland. It was planned to analyze the vegetation of these sites again in the following two years. These data were to provide an assessment of the short term effects of sagebrush control. Unfortunately, four of the eight blocks intended to be left unsprayed suffered slight to moderate damage from spray drift. These blocks were, therefore, abandoned. On two of these four projects, Coyote Creek and Horse Creek, other sites were found for analysis so that six 1970 projects had study sites. The block at Horse Cr. is mapped as Site 3, but no data are presented. Two 1970 projects, Beal's Lake and Red Rock, were completely abandoned.

In total, 26 sites in 15 projects were studied. Figure 1 (two

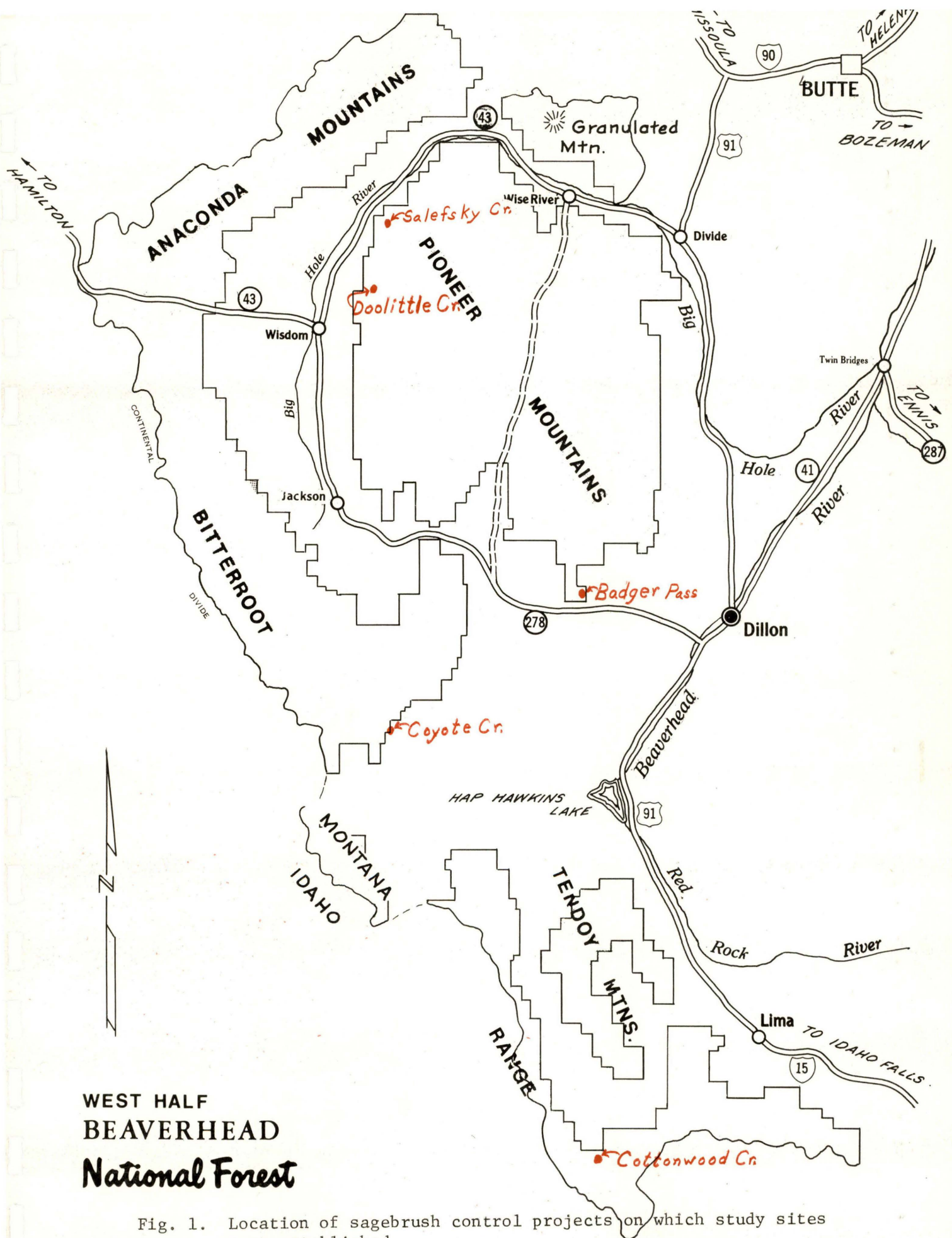
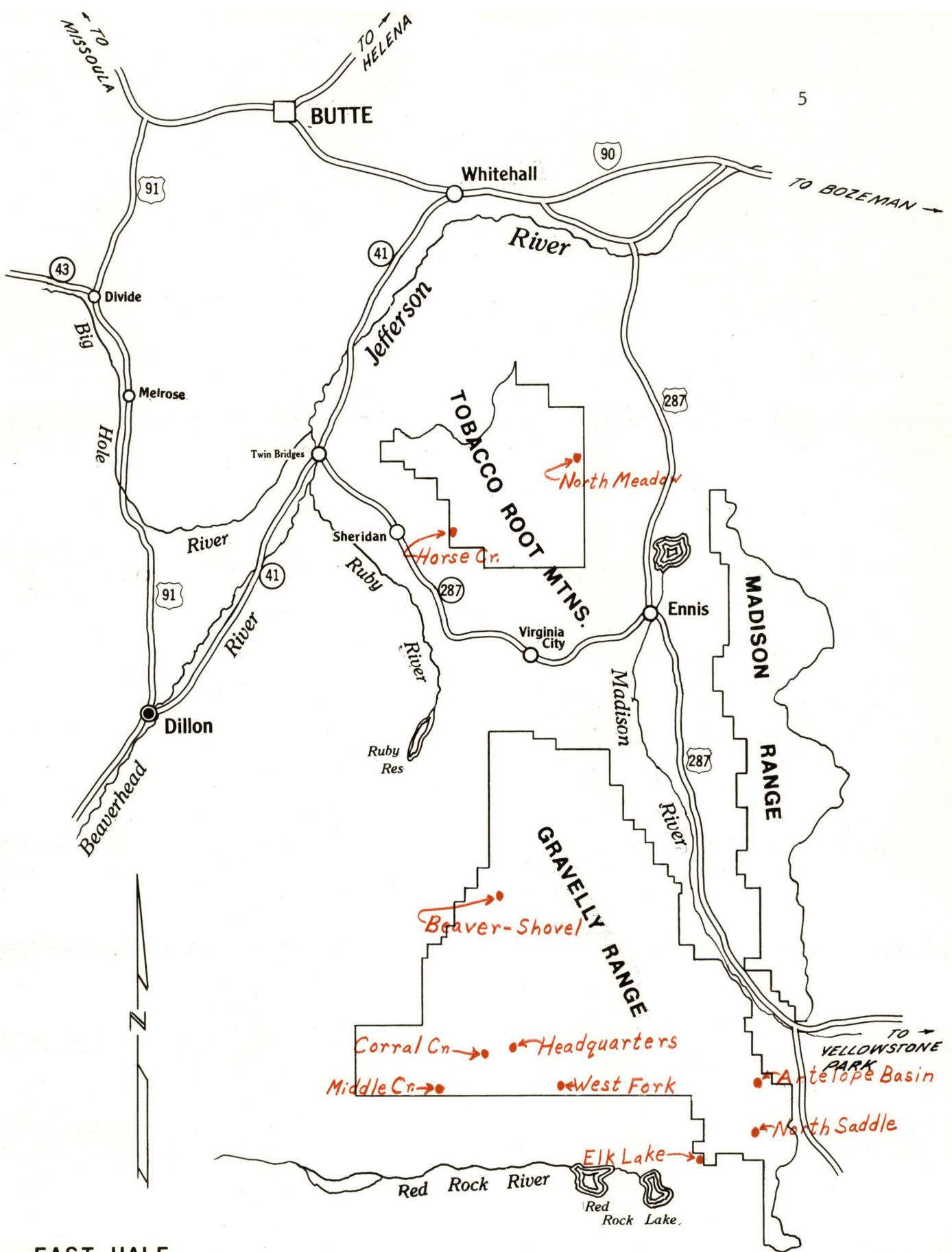


Fig. 1. Location of sagebrush control projects on which study sites were established.



EAST HALF BEAVERHEAD National Forest

Fig. 1. (Continued)

pages) shows the locations of the 15 projects involved in this study.

Sites were selected where unsprayed and sprayed rangeland had the same slope, exposure, and gross soils characteristics. Evidence of dead sagebrush plants on the sprayed area in the approximate density of the live sagebrush on the unsprayed area was used as an indicator of homogeneity of the site and the vegetation before spraying.

A visual inspection of the unsprayed range and sprayed range in the vicinity of the proposed sampling lines or blocks was made to estimate the similarity of the sampling area and surrounding vegetation. This inspection served to assure that the vegetation of the sprayed range in the sampling area was not unduly influenced simply by being relatively close to the unsprayed range. Both the sprayed and unsprayed ranges were available to grazing as soon as grazing was permitted in the pasture unit. It is assumed that the grazing pressures had been essentially the same on both the sprayed and unsprayed vegetation. Time did not permit more than a cursory examination of the site to see that there were no unusual concentrations of game pellet groups or cow pads on the unsprayed or sprayed range.

Once a site was established a sampling line or rectangular sampling block was selected on the unsprayed range and another on the sprayed range.

Vegetation was analyzed by cover estimation based on the Daubenmire concept.^{1/}

At the beginning of the study, 100 2 x 5 dm plots were used but

^{1/} Daubenmire, R. 1959. A canopy-coverage method of vegetational analysis. Northwest Science 33(1), 43-64.

this sample failed to give statistically reliable results for most samples of the major species and groupings (forbs, grasses, shrubs). The plot size was changed to 4 x 5 dm which yielded more satisfactory data. A test of numbers of plots required indicated that a great deal of field time would be saved and only a small amount of statistical reliability would be lost by reducing the sample to 50 plots. Therefore, most of the work was done with 50 4 x 5 sq dm plots on the sprayed range and 50 plots on the unsprayed range.

All species data were automatically tested in the computer for adequacy of the sample. Generally speaking, the sampling was adequate for the major grasses and forbs on a site and for big sagebrush on unsprayed range. It was inadequate for many forbs and other shrub species. It was more than adequate for total grasses and total forb groupings.

In spite of the lack of adequate sampling for many species on individual sites, trends in speciation changes are indicated by looking at responses on all sites.

Production data were taken in 1970 and 1971. Every fifth plot was clipped by species. The clippings were oven dried and weighed. This was a very time consuming operation and did not appear to yield information that was of any more value than the cover data for the purposes of this study. Further, regression analyses indicated that weight and cover were closely enough related (Table 1) for the more common species that cover data were considered adequate. Consequently, no production data were taken in 1972. This enabled the field crew to sample more sites than had been sampled in either of the previous summers.

Table 1. Correlation and regression values of cover (X) and weight (Y), all samples combined.

Species	No. of Samples	Correlation Coefficient	Regression Equation
Agropyron dasystachyum	43	.78**	Y = 2.97 + 2.10X
Agropyron spicatum	67	.87**	Y = -.34 + 3.80X
Bromus marginatus	20	.84**	Y = -15.33 + 17.07X
Bromus tectorum	6	.97**	Y = .04 + 2.35X
Carex spp.	36	.94**	Y = .25 + 1.97X
Danthonia unispicata	4	.90*	Y = -.53 + 3.43X
Festuca idahoensis	124	.72**	Y = 2.76 + 1.57X
Koeleria cristata	20	.88**	Y = -.01 + 2.90X
Melica bulbosa	7	.23	
Poa spp.	109	.95**	Y = -.44 + 2.52X
Stipa comata	59	.90**	Y = .79 + 2.59X
Stipa richardsoni	8	.32	
Total grasses	520	.62**	Y = .78 + 2.60X
Achillea millefolium	60	.22	
Agoseris glauca	10	.84**	Y = -.11 + 1.39X
Arenaria congesta	40	.65**	Y = .44 + 2.12X
Arnica fulgens	25	.77**	Y = .25 + .59X
Arabis holboellii	9	.29	
Astragalus miser	18	.54*	Y = .56 + 1.39X
Balsamorhiza sigattata	4	.84	
Calochortus nitidus	13	.64*	Y = -.02 + 2.08X
Campanula rotundifolia	6	.91**	Y = -.10 + 2.88X
Clematis hirsutissima	4	.91*	Y = -.71 + 3.10X
Collinsia parviflora	28	.65**	Y = .04 + .76X
Collomia linearis	46	.91**	Y = .24 + 1.31X
Comandra umbellata	20	.74**	Y = -.22 + 4.11X
Delphinium bicolor	24	.61*	Y = .13 + .61X
Draba nemorosa	16	-.14	
Erysimum inconspicuum	10	.94**	Y = -.93 + 8.50X
Fritillaria atropurpurea	6	.05	
Galium boreale	6	.85*	Y = .46 + .91X
Geranium viscosissimum	8	.93**	Y = .28 + 1.83X
Geum triflorum	6	.98**	Y = -.20 + 1.96X
Lappula redowskii	7	.96**	Y = 2.22 + 1.20X
Lithophragma parviflora	6	.44	
Lithospermum pilosum	7	.40	
Lomatium triternatum	17	.94**	Y = -.25 + 3.05X
Lupinus spp.	92	.85**	Y = -.95 + 2.42X
Microseris nutans	5	.56	
Penstemon eriantherus	6	.90**	Y = -.17 + 2.45X
Phlox longifolia	54	.76**	Y = -.54 + 3.64X
Polygonum aviculare	26	.87**	Y = .78 + .76X
Potentilla gracilis	9	.88**	Y = -1.35 + 3.11X
Senecio lugens	7	.93**	Y = .47 + 1.67X
Taraxacum laevigatum	11	.57	
Tragopogon dubius	10	.98**	Y = -1.78 + 9.38X
Viola nuttallii	16	.42	
Total forbs	699	.76**	Y = .20 + 1.77X

*Correlation significant at P=.05; **significant at P=.01

On most of the sites, sagebrush plants occurring on the plots were counted as well as being included in the cover measurements. The plants were aged by ring counts if there was doubt as to whether they were established before or after the spraying was done.

As time permitted, some supplementary data on sagebrush populations were obtained. Numbers of sagebrush plants were counted on 50 4x5 dm plots on paced transects approximately 1500 feet long. One to three transects were sampled. A few projects were not so sampled.

Very limited soils data were gathered at many of the sites and are reported in the appendix.

LIMITATIONS: The data presented in this study should be useful in a number of ways, but there are certain limitations that must be remembered.

- 1). Small differences in cover of individual species should not be given importance in making data interpretations. The methodology used is dependent to a considerable degree on judgement. This means that decisions on cover will vary somewhat between persons, the environment affecting the field worker and all the other influences that tend to affect how well anyone does a job. Field procedure was developed to minimize these influences and their effects on the net results of the work but judgement still was a part of the process.
- 2). Agropyron spicatum includes A. caninum (A. subsecundum, A. trachycaulum, A. pauciflorum). The field work was initiated each year before grasses were in head and all but the

earliest forbs were in flower. The forbs could be recognized fairly easily by leaf characteristics. Some grasses were much more difficult. Attempts to separate A. spicatum and A. caninum by vegetative characteristics in very young plants were not consistently successful, and also were very time consuming; consequently it was decided to put both these species under A. spicatum. This was continued throughout the season even though the difference became readily apparent as seedstalks developed. As it turned out, A. spicatum was the common species. A. caninum was not abundant on any of the sites studied.

3). Cover and production should not be compared among sites.

Field work started fairly early in the developmental stages of the vegetation. Both cover and production would be less on sites sampled early than on those sampled late. The only proper comparison is between unsprayed and sprayed range on a site.

RESULTS

Results for each study site are presented in tabular and graphic form in the appendix. The section immediately following this page provides a summary of the results for all sites over the three year period.

The statements made throughout this report are based on the assumption that differences in vegetation between the sample data of sprayed and unsprayed ranges are due to spraying unless otherwise noted. The language used often will reflect this assumption.

Response of the total vegetation

It seems useful to comment on total vegetational changes as an overview before going into details concerning plant group and species changes. The differences in total vegetational cover by site are illustrated in Figure 2. It will be noted that some sites have more than 20 sq dm cover. This is common in thick, multi-storied vegetation with the method used in this study.

The total vegetational cover values and differences between unsprayed and sprayed ranges are shown in Table 2.

Total cover values decreased on sprayed range slightly to very markedly at 20 sites; it increased slightly to moderately on five sites; and it stayed essentially the same on one site.

Very large reductions (over 50 percent at Beaver-Shovel #1) occurred, but most reductions in cover were under 20 percent. The average was 13 percent. At no site was all the reduction accounted for by an increase in bare ground. As a matter of fact, the average bare ground change for all sites was only +.1 sq dm per 20 sq dm plot, while the average vegetational cover change was -2.6 sq dm per 20 sq dm plot. Thus, it appears that the cover reduction is due to the change from a two story vegetation (with sagebrush) to a one story vegetation (without sagebrush) as a result of spraying.

The reaction of the three major groupings of plants (grasses and sedges, forbs, shrubs) are shown in Figure 3. In general, the primary changes in vegetation following spraying are a major increase in grass and a major decrease in shrubs. Forbs are only moderately affected. The results for each group and species within the groups are given more thorough analysis in the remainder of the report.

Fig. 2. Differences in total plant cover between unsprayed and sprayed vegetation at 26 sites.

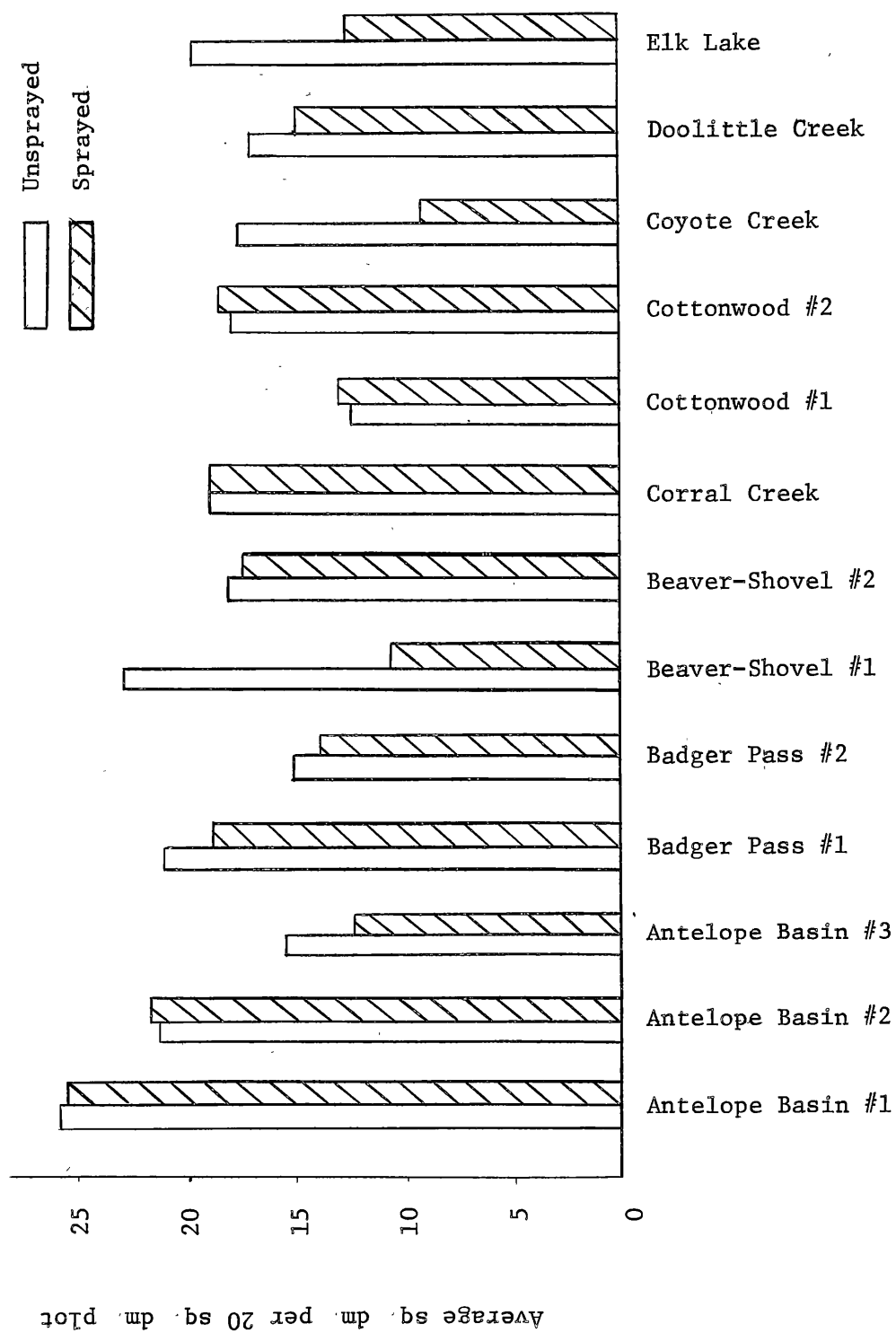


Fig. 2. (Continued)

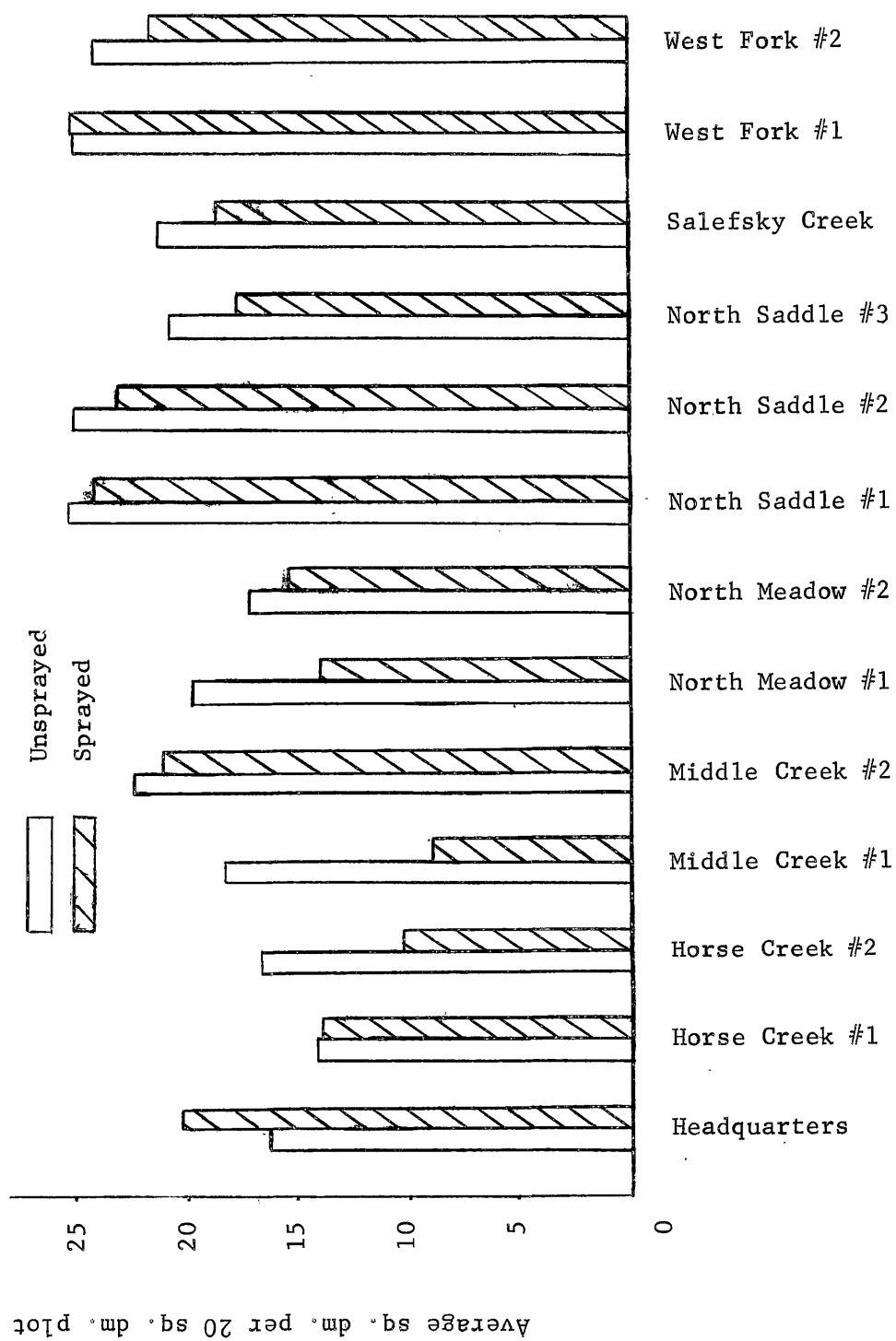
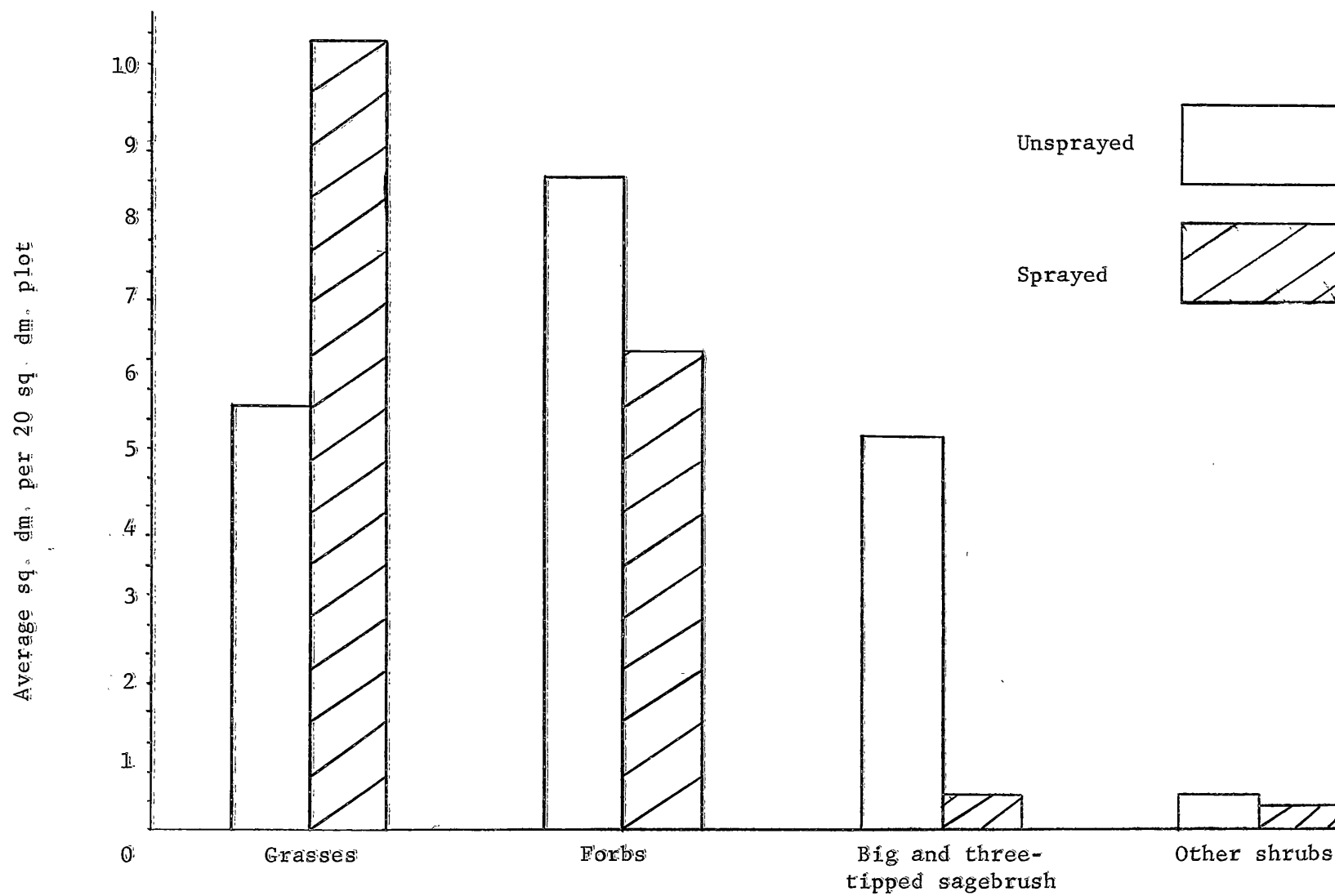


Table 2. Differences in total plant cover between unsprayed and sprayed vegetation at 26 sites.

	Unsprayed	Sprayed	Difference
Antelope Basin #1	25.9 ^{1/}	25.6	- .3
#2	21.3	21.7	+ .4
#3	15.5	12.3	- 3.2
Badger Pass #1	21.1	18.9	- 2.2
#2	15.3	13.9	- 1.4
Beaver-Shovel #1	23.0	10.5	-12.5
#2	18.3	17.5	- .8
Corral Cr.	19.1	19.1	None
Cottonwood #1	12.5	13.0	+ .5
#2	18.1	18.7	+ .6
Coyote Cr.	17.9	9.2	- 8.7
Doolittle	17.2	15.2	- 2.0
Elk Lake	20.0	12.9	- 7.1
Headquarters	16.4	20.4	+ 4.0
Horse Cr. #1	14.4	14.1	- .3
#2	16.7	10.4	- 6.3
Middle Cr. #1	18.3	9.0	- 9.3
#2	22.6	21.2	- 1.4
North Meadow #1	19.9	14.1	- 5.8
#2	17.3	15.6	- 1.7
North Saddle #1	25.5	24.4	- 1.1
#2	25.2	23.3	- 1.9
#3	20.9	17.9	- 3.0
Salefsky Cr.	21.4	18.8	- 2.6
West Fork #1	25.2	25.3	+ .1
#2	24.2	21.7	- 2.5
AVERAGE	19.7	17.1	- 2.6

^{1/} Figures are average sq dm per 20 sq dm plot.

Fig. 3. Average cover data for vegetation groupings on unsprayed and sprayed vegetation at 26 sites.



The Central Question - What Happened to the Forbs?

Attention in this section is centered on the fate of forbs following spraying for sagebrush control. The responses of the non-forb components are discussed in following sections.

When all 26 sites were averaged, forbs as a group showed some reduction on sprayed range (Figure 3). This generalization is indicative of forb response but not very useful to the range manager.

The responses of the total forb component for each of the sites is shown in Figure 4 and Table 3.

Forb values decreased on 21 of the 26 sites and increased on 5 sites. The five sites were both Cottonwood sites (2.9 to 3.7 sq dm per 20 sq dm plot, and 9.6 to 10.6 sq dm), Headquarters (8.3 to 9.0), and the two West Fork sites (12.7 to 16.3, and 10.3 to 10.6). The spraying on these three projects had been done 11, 5 and 13 years prior to sampling, respectively. It appears that the environment (both natural and man-influenced) on these projects favored the forbs as replacement vegetation. However, the difference on one West Fork site falls within sampling error limits and the difference on one Cottonwood site is marginal.

The decreases on the 21 sites varied from 6.7 sq dm to 1.0 sq dm per 20 sq dm plot. The forb populations of the sprayed ranges are very low in several sites. But these sites also are low in forbs on the unsprayed range in comparison to other unsprayed ranges.

These results indicate that reductions in forb cover, most likely in the 40 to 60 percent range, can be expected in the first year or two after spraying. The differences in forb populations between unsprayed

Fig. 4. Differences in average forb cover between unsprayed and sprayed vegetation at 26 sites.

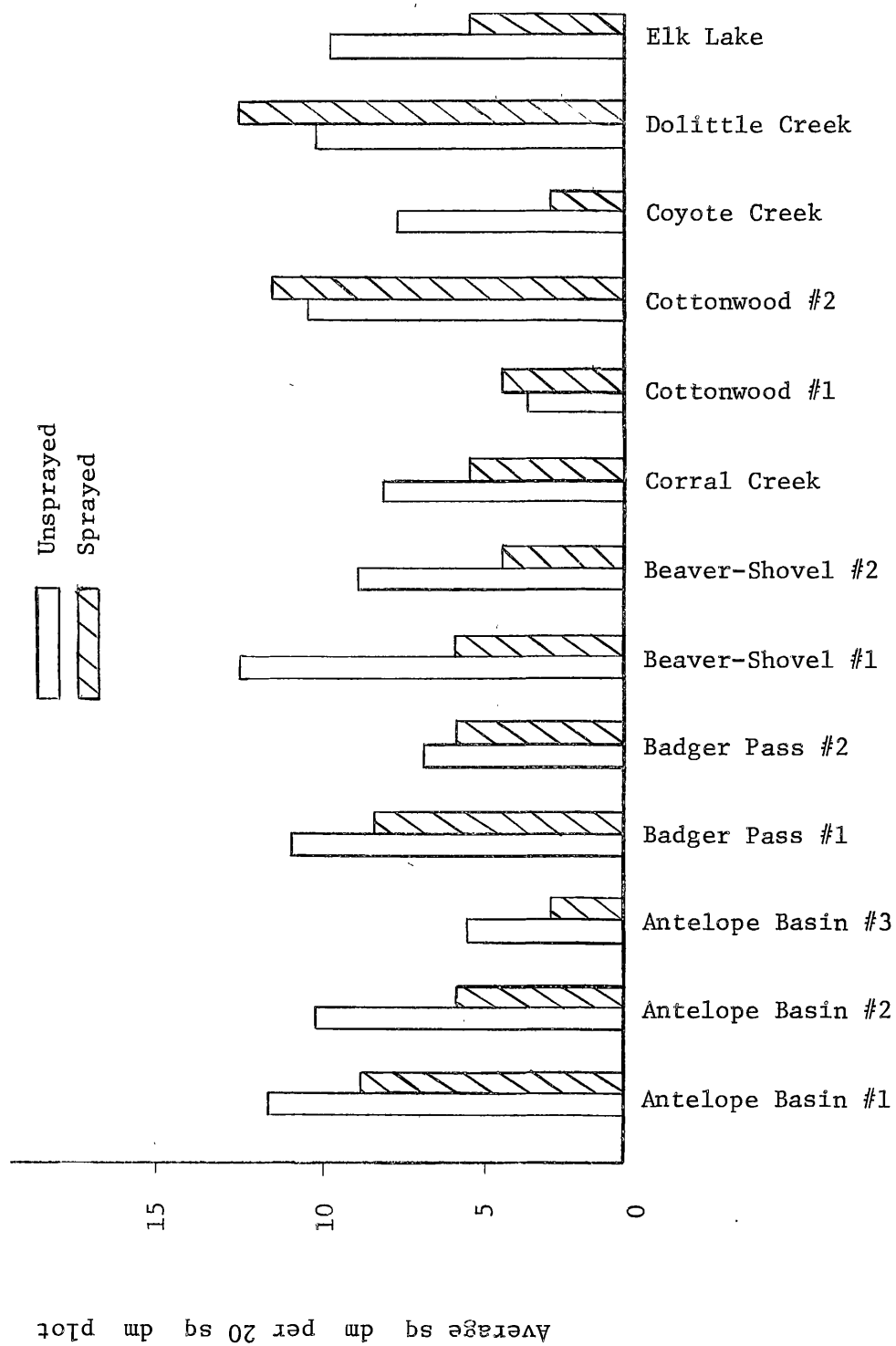


Fig. 4. (Continued)

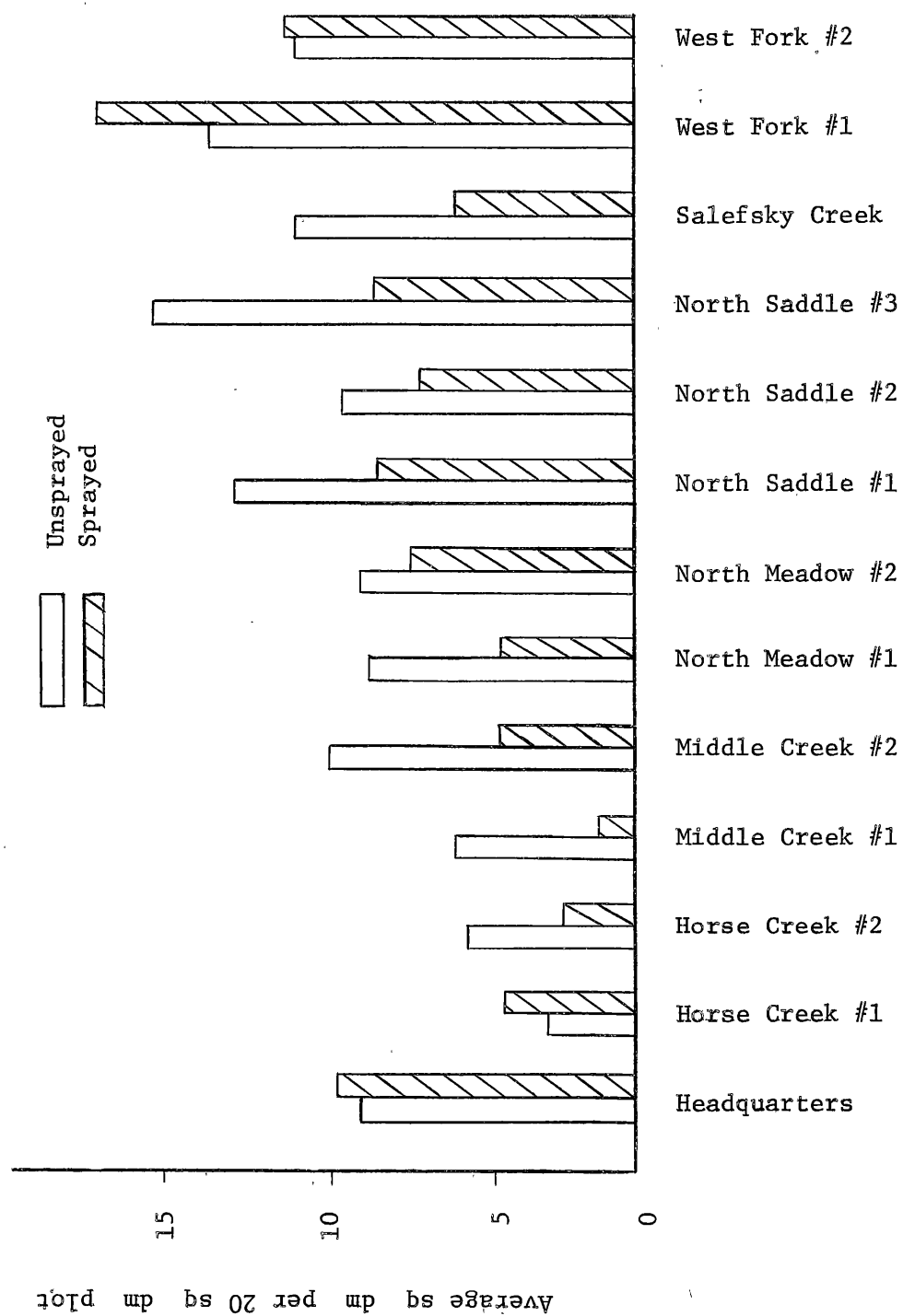


Table 3. Quantitative differences in forb cover between unsprayed and sprayed range on 26 sites

	FORBS			
	Unsprayed	Sprayed	Difference	% ^{2/} Difference
Antelope Basin #1	10.7 ^{1/}	7.9	- 2.8	- 26%
#2	9.3	5.0	- 4.3	- 46
#3	4.7	2.2	- 2.5	- 53
Badger Pass #1	10.0	7.5	- 2.5	- 25
#2	6.1	5.1	- 1.0	- 16
Beaver Shovel #1	11.6	5.1	- 6.5	- 56
#2	8.0	3.6	- 4.4	- 55
Corral Cr.	7.3	4.8	- 2.5	- 34
Cottonwood Cr. #1	2.9	3.7	+ 0.8	+ 28
#2	9.6	10.6	+ 1.0	+ 10
Coyote Cr.	6.9	3.6	- 3.3	- 48
Doolittle Cr.	11.7	9.3	- 2.4	- 21
Elk Lake	8.9	4.7	- 4.2	- 47
Headquarters	8.3	9.0	+ 0.7	+ 8
Horse Cr. #1	2.6	3.9	+ 1.3	+ 50
#2	5.1	2.2	- 2.9	- 57
Middle Cr. #1	5.4	1.1	- 4.3	- 80
#2	9.3	4.1	- 5.2	- 56
North Meadow #1	8.0	4.0	- 4.0	- 50
#2	8.3	6.7	- 1.6	- 19
North Saddle #1	12.1	7.8	- 4.3	- 36
#2	8.7	6.5	- 2.2	- 25
#3	14.5	7.8	- 6.7	- 46
Salefsky	10.2	5.4	- 4.8	- 47
West Fork #1	12.7	16.3	+ 3.6	+ 28
#2	10.3	10.6	+ 0.3	+ 3
Average	8.6	6.1	- 2.5	29%

^{1/} Values are average sq dm per 20 sq dm plot.

^{2/} Percentage values are determined by dividing the difference values by the unsprayed range values.

and sprayed ranges tend to narrow with time, although this is by no means consistent.

The averages of Figure 4 and Table 3 do not indicate how individual species react to spraying. The quantitative data for a particular species can be obtained by going through the individual site data in the appendix. An easier way to see the variability in species reactions among sites is to see whether a given species increased, decreased or did not change in each site between unsprayed and sprayed ranges. This is shown in Table 4.

A species having a sprayed range cover value of at least .1 sq dm less than on unsprayed range was labeled "D" (decrease), except that a species occurring on unsprayed range and absent on sprayed range was labeled "0". A species having a sprayed range cover value of at least .1 sq dm more than on unsprayed range was labeled "I" (increase). Where the cover values were the same on both unsprayed and sprayed ranges, "=" (equal) was used. Only those species occurring in three or more sites are included.

Table 5 is a summary of the reactions in Table 4. In this Table the "D" and "0" symbols have been added together in the "decreased cover" column.

It is evident in looking at these two tables that the reactions of most species to spraying are not consistent from site to site. Most species had both "D" and "I" symbols. Only two species (Potentilla arguta, Sedum stenopetalum) decreased from unsprayed to sprayed range at all sites where they occurred. A few more species showed only decreases and "no change": Arabis holboellii, Dodecatheon conjugens, Erigeron spp., Fritillaria atropurpurea and Hieracium scouleri. All

Table 4. Changes in cover values of individual forb species between unsprayed and sprayed vegetation.1/

FORBS	Antelope Basin #1	Antelope Basin #2	Antelope Basin #3	Badger Pass #1	Badger Pass #2	Beaver-Shovel #1	Beaver-Shovel #2	Corral Creek	Cottonwood #1	Cottonwood #2	Coyote Creek	Dolittle Creek	Elk Lake	Headquarters	Horse Creek #1	Horse Creek #2	Middle Creek #1	Middle Creek #2	North Meadow #1	North Meadow #2	North Saddle #1	North Saddle #2	North Saddle #3	Salefsky Creek	West Fork #1	West Fork #2
Achillea millefolium	D = D	I D	= D	I	D I	D	I	D I	D	= D	I	D I	D I	D I	D I	D I	D I	D D	D D	D I	I	I	I	D I		
Agoseris glauca	D D D	I D		D							D		D		0			0	D I	D	0	I I		I I		
Anaphalis margaritacea									I		I									D D	D					
Antennaria rosea	D D D	I I	D D	D	I I	D I	D	I I	D I	D	I	D	0	D D	0	0	D		D D	D						
Arabis holboëllii		D D =		0							=								D							
Arenaria congesta	I	0	=	I	I	I	D		D	I	D		D	I	D			I	D I	D			I			
Arnica fulgens	D D	I D	0						D	=				I			D		I I	D D						
Astragalus miser	D I	I D	D					I D			I								D							
Astragalus spp.								D					I									D				
Besseyia wyomingensis	D								=										D	I						
Campanula rotundifolia	D													I					= I							
Castilleja flava		D =				D I																0				
Cerastium nutans	I		0														I		D	D		D I				
Clematis hirsutissima	I		D	0										D			D	D	0 =	D						
Collinsia parviflora		I								I I				I				=	0	D		I				
Collomia linearis	D I		D I			D	I		D =	I				I				I I	D D			I I				
Comandra umbellata												D		I	0		D									
Delphinium bicolor										I =				D D			I									
Dodecatheon conjugens	=	D									=				D					=	D					
Erigeron alpinus	D D										D	=				I			I D	D I		D				
Erigeron spp.	0		D					=									D									

Continued on next page.

Table 4. (Continued.)

FORBS - (continued)	Antelope Basin #1	Antelope Basin #2	Antelope Basin #3	Badger Pass #1	Badger Pass #2	Beaver-Shovel #1	Beaver-Shovel #2	Corral Creek	Cottonwood #1	Cottonwood #2	Coyote Creek	Dolittle Creek	Elk Lake	Headquarters	Horse Creek #1	Horse Creek #2	Middle Creek #1	Middle Creek #2	North Meadow #1	North Meadow #2	North Saddle #1	North Saddle #2	North Saddle #3	Salefsky Creek	West Fork #1	West Fork #2
<u>Frageria virginiana</u>	I										D			D			O				I	D				
<u>Fritillaria atropurpurea</u>																D					D		D			
<u>Galium boreale</u>	D					O D			I					I			D	D					I			
<u>Geranium viscosissimum</u>	D D					O D					O D			I			O D	I I	D	D	D	D	D	I		
<u>Geum triflorum</u>	= O					O D	D		D		I			O			D		O	O D	D	O		I		
<u>Helianthus annuus</u>																	D				I			D		
<u>Heuchera parviflora</u>	I								=												D					
<u>Hieracium scouleri</u>											= D							O								
<u>Lappula redowskii</u>	D													I			D D		D	O D	D		I =			
<u>Linum perenne</u>	I																				D		=			
<u>Lomatium triternatum</u>				= D							D I				D				I		D D	D	D			
<u>Lupinus spp.</u>	D D D	D D	D D	D D	D D	D D	D D	I	D D	D D	D D	D D	D D	D D	D D	D D	D D	D I	I D	=	D D	D D				
<u>Mertensia longiflora</u>				D D								D O												I		
<u>M. oblongifolia</u>				D D							O I				D		D									
<u>Microseris nutans</u>		D									O I							=					O	D		
<u>Penstemon aridus</u>						D			=								I				I	D	D			
<u>Phacelia heterophylla</u>														I							O		I			
<u>Phlox hoodii</u>						I D	I I					I														
<u>Phlox kelseyi</u>									I													I		=		
<u>Phlox longifolia</u>	=	I I						I		= D					= D			D D	I D	D	D	D	=			

Continued on next page.

Table 4. (Continued.)

FORBS - (continued)	Antelope Basin #1	Antelope Basin #2	Antelope Basin #3	Badger Pass #1	Badger Pass #2	Beaver-Shovel #1	Beaver-Shovel #2	Corral Creek	Cottonwood #1	Cottonwood #2	Coyote Creek	Dolittle Creek	Elk Lake	Headquarters	Horse Creek #1	Horse Creek #2	Middle Creek #1	Middle Creek #2	North Meadow #1	North Meadow #2	North Saddle #1	North Saddle #2	North Saddle #3	Salefsky Creek	West Fork #1	West Fork #2
Polygonum aviculare																			= I						=	
Potentilla arguta	D	O				O								O			O		D	D	O	D		O		
P. gracilis	I	O					D							D			D		D	D	I	D	O	I	I	
Ranunculus glaberrimus		O																			I	= I				
Rumex paucifolius	I					D						I									D	I	D		I	
Sedum stenopetalum					D						D					D										
Senecio canus				D								I										D	D	O		
S. lugens							I			D													I			
Taraxacum laevigatum	D	D	D	I		=	D	=	D	I	=	I	D	D	D				I	D	D	I	=	=	I	
Thalictrum occidentale														O				I							I	
Tragopogon dubius		O																	I	D		I				
Viola nuttallii	D	O				D	D				D	=			D							D	I	I	I	=
TOTAL FORBS	D	D	D	D	D	D	D	D	I	I	D	D	D	I	D	D	D	D	D	D	D	D	D	D	I	I

- 1/ I = Sprayed value increased by at least 0.1 sq dm from unsprayed value.
D = Sprayed value decreased by at least 0.1 sq dm from unsprayed value.
O = Unsprayed value at least 0.1 sq dm and sprayed value 0.0.
= = Unsprayed value at least 0.1 sq dm and equal to sprayed value.

Only species yielding data from 3 or more sites are included in the table.

Table 5. Summary of numbers of sites at which forb species increased, decreased, or did not change as a result of spraying for sagebrush control.

FORBS	Number of sites with increased cover on sprayed range	Number of sites with decreased cover on sprayed range	Number of sites with no change	Number of sites species occurs as traces or not occurring
<i>Achillea millefolium</i>	10	13	3	0
<i>Agoseris glauca</i>	4	12	0	10
<i>Anaphalis margaritacea</i>	2	3	0	21
<i>Antennaria rosea</i>	5	17	0	4
<i>Arabis holboellii</i>	0	4	2	20
<i>Arenaria congesta</i>	8	6	1	11
<i>Arnica fulgens</i>	4	8	1	12
<i>Astragalus miser</i>	4	5	0	17
<i>Astragalus</i> spp.	1	2	0	23
<i>Besseyia wyomingensis</i>	1	2	1	22
<i>Campanula rotundifolia</i>	2	1	1	22
<i>Castilleja flava</i>	1	3	1	21
<i>Cerastium nutans</i>	3	4	0	19
<i>Clematis hirsutissima</i>	1	7	1	17
<i>Collinsia parviflora</i>	5	2	1	18
<i>Collomia linearis</i>	7	5	1	13
<i>Comandra umbellata</i>	1	3	0	22
<i>Delphinium bicolor</i>	2	2	1	21
<i>Dodecatheon conjugens</i>	0	3	3	20
<i>Erigeron alpinus</i>	3	6	1	16
<i>Erigeron</i> spp.	0	3	1	22

Continued on next page.

Table 5. (Continued)

FORBS - (continued)	Number of sites with increased cover on sprayed range	Number of sites with decreased cover on sprayed range	Number of sites with no change	Number of sites species occurs as traces or not occurring
<i>Frageria virginiana</i>	2	4	0	20
<i>Fritillaria atropurpurea</i>	0	3	1	22
<i>Galium boreale</i>	3	5	0	18
<i>Geranium viscosissimum</i>	4	11	0	11
<i>Geum triflorum</i>	2	12	1	11
<i>Helianthus annuus</i>	1	2	0	23
<i>Heuchera parviflora</i>	1	1	1	23
<i>Hieracium scouleri</i>	0	2	1	23
<i>Lappula redowskii</i>	2	7	1	16
<i>Linum perenne</i>	1	1	1	23
<i>Lomatium triternatum</i>	2	6	1	17
<i>Lupinus</i> spp.	3	22	1	0
<i>Mertensia longiflora</i>	1	4	0	21
<i>M. oblongifolia</i>	1	5	0	20
<i>Microseris nutans</i>	1	4	1	20
<i>Penstemon aridus</i>	2	3	1	20
<i>Phacelia heterophylla</i>	2	1	0	23
<i>Phlox hoodii</i>	4	1	0	21
<i>Phlox kelseyi</i>	2	0	1	23
<i>Phlox longifolia</i>	4	6	4	12

Continued on next page.

Table 5. (Continued.)

FORBS - (continued)	Number of sites with increased cover on sprayed range	Number of sites with decreased cover on sprayed range	Number of sites with no change	Number of sites species occurs as traces or not occurring
<i>Polygonum aviculare</i>	1	0	2	23
<i>Potentilla arguta</i>	0	10	0	16
<i>P. gracilis</i>	4	8	0	14
<i>Ranunculus glaberrimus</i>	2	1	1	22
<i>Rumex paucifolius</i>	4	3	0	19
<i>Sedum stenopetalum</i>	0	3	0	23
<i>Senecio canus</i>	1	4	0	21
<i>S. lugens</i>	2	1	0	23
<i>Taraxacum laevigatum</i>	6	10	5	5
<i>Thalictrum occidentale</i>	2	1	0	23
<i>Tragopogon dubius</i>	2	2	0	22
<i>Viola nuttallii</i>	3	7	2	14
TOTAL FORBS	5	21	0	0

other species had increased cover on sprayed range at one or more sites.

One other point should be noted. About twice as many changes to zero (plants present on the unsprayed range and absent on the sprayed range) occurred on the 12 sites sprayed in 1970 as occurred on the remaining 14 sites sprayed prior to 1970. This is reasonably good evidence that the immediate effect of spraying was detrimental but that some reestablishment of forbs took place over time. This has already been indicated by the fact that several of the sites on older spray projects had slightly greater total forb cover on the sprayed than on the unsprayed range.

Some further information of value in assessing susceptibility is the quantitative differences in cover of individual forb species between unsprayed and sprayed ranges. These data are presented in Table 6 for the more common forbs (those occurring at eight or more sites). Based on these data, Lupinus spp., Potentilla gracilis and Geum triflorum showed the greatest susceptibility to spraying. The quantitative differences for most of the species in the Table are small.

Some species apparently have high resistance to spraying or a capacity for rapid reestablishment following spraying, possibly both. Arenaria congesta, Collinsia parviflora, Collomia linearis and Phlox hoodii show more sites with higher cover values on sprayed range than on unsprayed range.

The classification of forb species into 2,4-D susceptibility groupings is largely interpretive. It depends first on the length of time after spraying which will be used as a basis for decision. As has

Table 6. Quantitative differences in the cover of the more common forb species between unsprayed and sprayed range, averaged for all sites on which each species occurred. Data are presented only for species which occurred on eight or more sites.

Species	Unsprayed ^{1/}	Sprayed ^{1/}	Difference ^{1/}
<i>Achillea millefolium</i>	.5	.6	+.1
<i>Agoseris glauca</i>	.4	.3	-.1
<i>Antennaria rosea</i>	.6	.4	-.2
<i>Arenaria congesta</i>	.4	.4	None
<i>Arnica fulgens</i>	.3	.3	None
<i>Astragalus miser</i>	.3	.4	+.1
<i>Clematis hirsutissima</i>	.2	.1	-.1
<i>Collomia linearis</i>	.3	.5	+.2
<i>Erigeron alpinus</i>	.7	.5	-.2
<i>Galium boreale</i>	.2	.2	None
<i>Geranium viscosissimum</i>	1.2	1.0	-.2
<i>Geum triflorum</i>	.6	.2	-.4
<i>Helianthus annuus</i>	.6	.3	-.3
<i>Lappula redowskii</i>	.8	.5	-.3
<i>Lomatium triternatum</i>	.1	.1	None
<i>Lupinus</i> spp.	1.5	.7	-.8
<i>Phlox longifolia</i>	.1	.2	+.1
<i>Potentilla arguta</i>	.3	T	-.3
<i>P. gracilis</i>	1.0	.4	-.6
<i>Taraxacum laevigatum</i>	.5	.4	-.1
<i>Viola nuttallii</i>	.2	.1	-.1

^{1/} Values are average sq dm per 20 sq dm plot.

already been pointed out the more years that elapse after spraying, the more likely there will be smaller differences in forb cover between sprayed and unsprayed ranges. Secondly, one might expect mixed reactions to spraying because all spray projects are not done at the same stage of plant development. The literature is replete with examples of highly varied susceptibilities within species when sprayed at different stages of growth. Thirdly, soil moisture and other factors of the environment influence susceptibility. Fourthly, systems of classification involve arbitrary selection of criteria for determining susceptibility classes. With all these factors to consider, it is obvious that two or more persons are likely to develop, from the same data, susceptibility lists that are somewhat different.

I have chosen to present two lists of the more common species in the Beaverhead National Forest. One lists reactions of forb species in the first two years after spraying. The other lists reactions over longer periods of time. Not all species are listed because of the limited data available for many of them.

I

Reactions in first two years

<u>Species consistently decreasing after spray- ing</u>	<u>Species with mixed reactions but more commonly decreasing</u>	<u>Species without a clear reaction</u>
<u>Antennaria rosea</u>	<u>Agoseris glauca</u>	<u>Achillea millefolium</u>
<u>Geranium viscosissimum</u>	<u>Arnica fulgens</u>	<u>Clematis hirsutissima</u>
<u>Geum triflorum</u>	<u>Astragalus miser</u>	<u>Collinsia parviflora</u>
<u>Lupinus</u> spp. (decreased with one exception)	<u>Cerastium nutans</u>	
	<u>Collomia linearis</u>	
<u>Potentilla arguta</u>	<u>Erigeron alpinus</u>	
	<u>Phlox longifolia</u>	
	<u>Potentilla gracilis</u>	
	<u>Taraxacum laevigatum</u>	

II

Reactions over periods longer than two years

<u>Species generally decreasing after spraying</u>	<u>Species with mixed reactions but more commonly decreasing after spraying</u>
<u>Clematis hirsutissima</u>	<u>Geum triflorum</u>
<u>Lupinus</u> spp.	
<u>Potentilla arguta</u>	
<u>Potentilla gracilis</u>	

Species with mixed
reactions but more
commonly increasing
after spraying

Astragalus miser

Collinsia parviflora

Phlox hoodii

(The remainder of the more common species do not
seem to fall into any of the above categories
since their reactions are very mixed among sites.)

In summary:

1. Forb cover generally, but not consistently, is reduced as a result of spraying for sagebrush control. The reduction is usually in the 40-60 percent range the first two years after spraying.
2. The differences in forb cover between unsprayed and sprayed ranges tend to narrow with time and may develop a greater total cover on sprayed ranges than on unsprayed ranges.
3. Listings of the reactions to spraying of the more common species in the Beaverhead National Forest have been presented. Such listings are interpretive and may be done differently by others.
4. A fairly large number of forb species were limited in their occurrence and hence yielded inadequate data for reliably determining responses to spraying. The range manager can estimate the possible, and perhaps probable, response for a given species by reviewing the data.

Response of Grasses and Sedges

The grasses generally increased in cover following spraying, as illustrated in Figure 5. In only one case, Beaver-Shovel Site 1, was the grass following spraying less than before spraying. There is no obvious reason for this one exception. A much more detailed study of the site would have been of value, but time did not permit it.

Table 7 shows the quantitative changes in grass cover by site. It is abundantly clear that the grass cover responds very positively to the reduction of competing vegetation. A comparison of the changes in forb cover and grass cover does not reveal a clear relationship between these two groups of vegetation. It thus appears that the major reason for the increase in grass is the reduction of sagebrush.

The reactions of grass species are shown in Tables 8 and 9. Most species increased following spraying. This pattern of responses was far more consistent than was the pattern of forb responses.

Quantitatively, the common grass species, with the exception of Danthonia intermedia, increased in cover, mostly by significant amounts (Table 10). Agropyron dasystachyum, Agropyron spicatum, Bromus marginatus, and Festuca idahoensis were the major increasing species. Danthonia intermedia and Stipa columbiana were not much affected.

The sedges (Carex spp.) reacted positively but not to the degree characteristic of the grasses.

Fig. 5. Differences in average grass cover between unsprayed and sprayed vegetation at 26 sites.

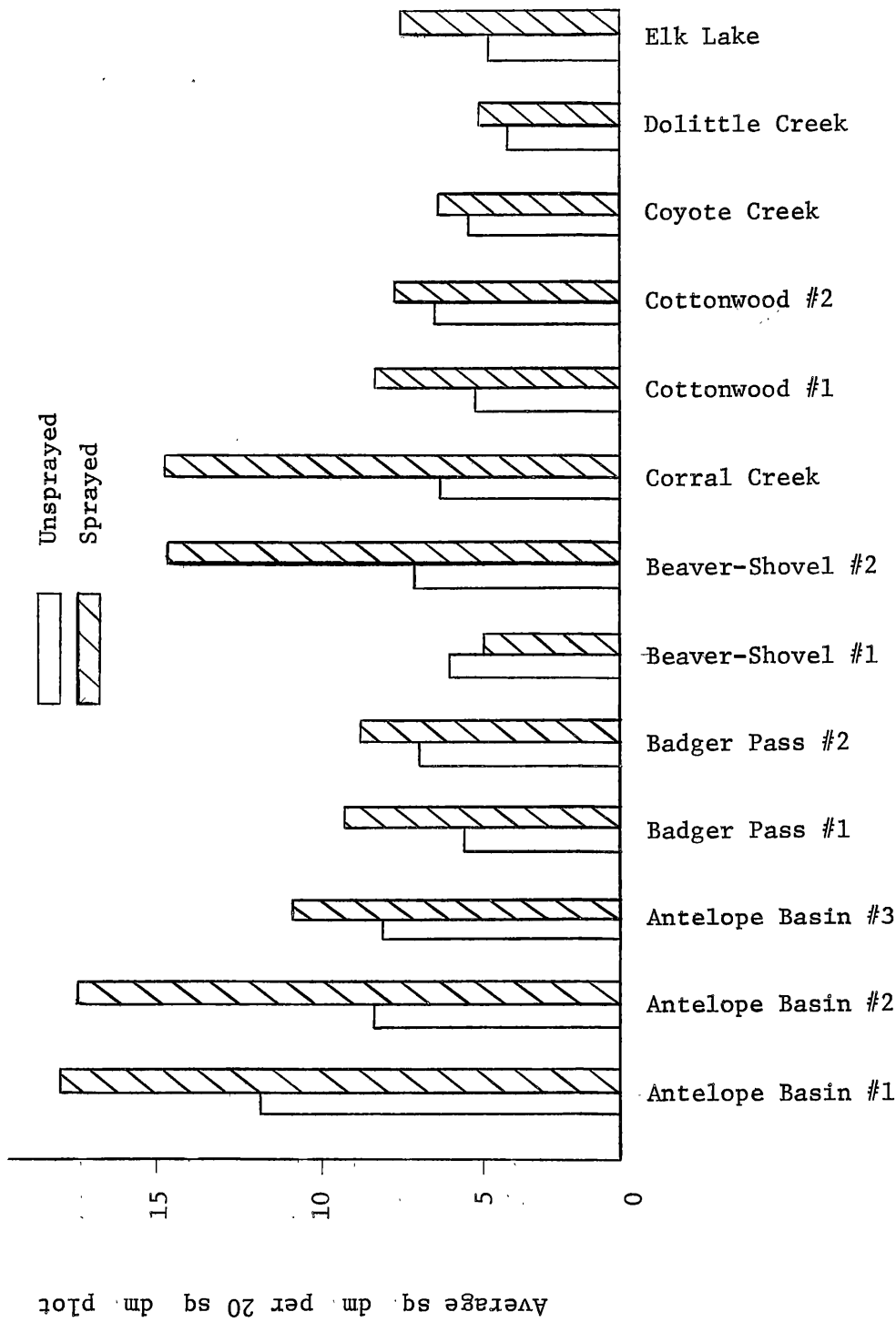


Fig. 5. (Continued)

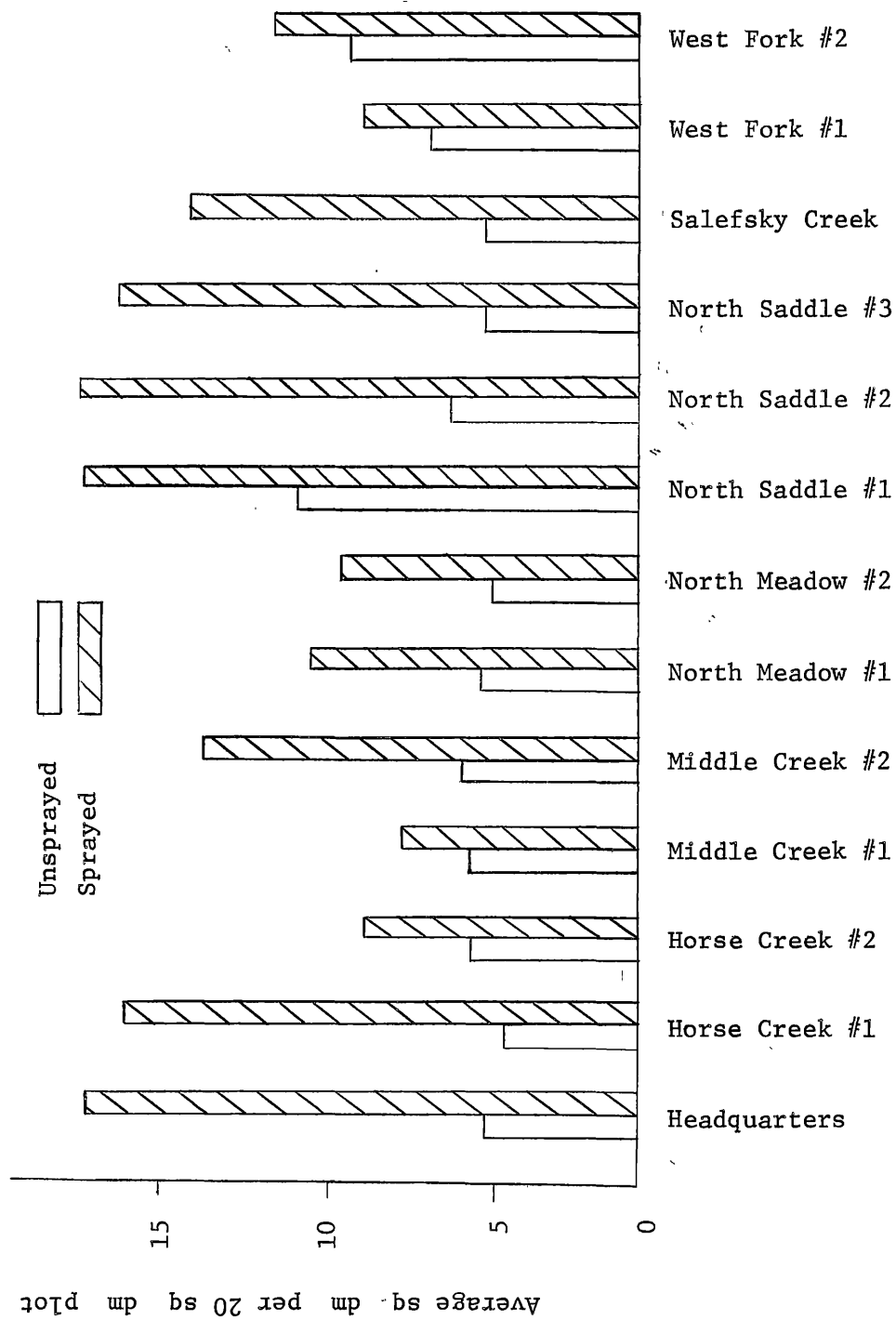


Table 7. Quantitative differences in grass cover between unsprayed and sprayed range on 26 sites

	GRASSES			
	Unsprayed	Sprayed	Difference	% ^{2/} Difference
Antelope Basin #1	11.0 ^{1/}	17.1	+ 6.1	+ 55%
#2	7.5	16.6	+ 9.1	+ 121
#3	7.2	10.0	+ 2.8	+ 39
Badger Pass #1	4.7	8.4	+ 3.7	+ 79
#2	6.1	7.9	+ 1.8	+ 30
Beaver- Shovel #1	5.2	4.1	- 1.1	- 21
#2	6.3	13.8	+ 7.5	+ 119
Corral Cr.	5.4	13.9	+ 8.5	+ 157
Cottonwood Cr. #1	4.4	7.5	+ 3.1	+ 70
#2	5.7	6.9	+ 1.2	+ 21
Coyote Cr.	4.6	5.6	+ 1.0	+ 22
Doolittle Cr.	3.5	4.3	+ 0.8	+ 23
Elk Lake	4.0	6.7	+ 2.7	+ 67
Headquarters	4.6	11.2	+ 6.6	+ 143
Horse Cr. #1	4.0	10.1	+ 6.1	+ 148
#2	5.0	8.2	+ 3.2	+ 64
Middle Cr. #1	5.1	7.0	+ 1.9	+ 37
#2	5.3	13.0	+ 7.7	+ 145
North Meadow #1	4.7	9.8	+ 5.1	+ 108
#2	4.4	8.9	+ 4.5	+ 102
North Saddle #1	10.2	16.6	+ 6.4	+ 63
#2	5.6	16.7	+11.1	+ 198
#3	4.6	10.1	+ 5.5	+ 120
Salefsky	4.6	13.4	+ 8.8	+ 191
West Fork #1	6.3	8.2	+ 1.9	+ 30
#2	8.6	10.8	+ 2.2	+ 26
Average	5.7	10.3	+ 4.6	+ 81%

^{1/} Values are average sq dm per 20 sq dm plot.

^{2/} Percentage values are determined by dividing the difference values by the unsprayed range values.

Table 8. Changes in cover values of individual grass species between unsprayed and sprayed vegetation at 26 sites.^{1/}

GRASSES AND SEDGES	Antelope Basin #1	Antelope Basin #2	Antelope Basin #3	Badger Pass #1	Badger Pass #2	Beaver-Shovel #1	Beaver-Shovel #2	Corral Creek	Cottonwood #1	Cottonwood #2	Coyote Creek	Dolittle Creek	Elk Lake	Headquarters	Horse Creek #1	Horse Creek #2	Middle Creek #1	Middle Creek #2	North Meadow #1	North Meadow #2	North Saddle #1	North Saddle #2	North Saddle #3	Salefsky Creek	West Fork #1	West Fork #2
<i>Agropyron dasystachyum</i>								I					D	I			I		D							
<i>A. smithii</i>						D	I		=												=					
<i>A. spicatum</i>	I	I	I	I	I				I	=	I	I	I		II	I	I	I	I	I	I	I	I	D	I	I
<i>Bromus inermis</i>	I	I																			0	I				
<i>B. marginatus</i>	D	I	0			I	D	=						I			D	I	D	I	D	I	=	I	I	I
<i>Carex</i> spp.	I	I	I			I	0	D	I	I	I	D	I				D	I	=	=	I	I	I	I	D	I
<i>Danthonia intermedia</i>	D	I				D		D														I				
<i>D. unispicata</i>	D											I												D		
<i>Festuca idahoensis</i>	I	I	I	I	I	D	I	I	I	D	I	D	I	I	I	I	I	D	D	I	I	I	I	I	D	I
<i>Koeleria cristata</i>	I	I	I	I		=	I		I	=	I	I	=	I	I				I	I	I	I	I	I	I	I
<i>Melica bulbosa</i>																	D	D			I			D		
<i>Poa</i> spp.	I	D	I	I	D	D	I	I	I	D	I	I	I	I	I	I	I	I	I	=	I	I	I	I	D	I
<i>Stipa columbiana</i>		0	D			I			I					I			I	I								
<i>S. comata</i>	D	I	I			=	I	D				I	I		I	I			I	I	I	I	I	I	D	D
TOTAL GRASSES AND SEDGES	I	I	I	I	I	D	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I

- ^{1/} I = Sprayed value increased by at least 0.1 sq dm from unsprayed value.
 D = Sprayed value decreased by at least 0.1 sq dm from unsprayed value.
 0 = Unsprayed value at least 0.1 sq dm and sprayed value 0.0.
 = = Unsprayed value at least 0.1 sq dm and equal to sprayed value.

Only species yielding data from 3 or more sites are included in the table.

Table 9. Summary of numbers of sites at which grass species increased, decreased, or did not change as a result of spraying for sagebrush control.

GRASSES AND SEDGES	Number of sites with increased cover on sprayed range	Number of sites with decreased cover on sprayed range	Number of sites with no change	Number of sites species occurs as traces or not occurring
<i>Agropyron dasystachyum</i>	3	2	0	21
<i>A. smithii</i>	1	1	2	22
<i>A. spicatum</i>	18	2	1	5
<i>Bromus inermis</i>	3	1	0	22
<i>B. marginatus</i>	8	6	2	10
<i>Carex</i> spp.	13	5	2	6
<i>Danthonia intermedia</i>	2	3	0	21
<i>D. unispicata</i>	1	2	0	23
<i>Festuca idahoensis</i>	20	6	0	0
<i>Koeleria cristata</i>	15	0	3	8
<i>Melica bulbosa</i>	1	3	0	22
<i>Poa</i> spp.	20	5	1	0
<i>Stipa columbiana</i>	5	2	0	19
<i>S. comata</i>	13	4	1	8
TOTAL GRASSES AND SEDGES	25	1	0	0

Table 10. Quantitative differences in the cover of the more common grass species between unsprayed and sprayed range, averaged for all sites on which each species occurred. Data are presented only for species which occurred on five or more sites.

Species	Unsprayed ^{1/}	Sprayed ^{1/}	Difference ^{1/}
Agropyron dasystachyum	.7	1.8	+1.1
A. spicatum	.7	1.6	+ .9
Bromus marginatus	.8	1.5	+ .7
Carex spp.	.5	.7	+ .2
Danthonia intermedia	.3	.2	- .1
Festuca idahoensis	2.4	4.0	+1.6
Koeleria cristata	.2	.6	+ .4
Poa spp.	.6	1.2	+ .6
Stipa columbiana	.4	.6	+ .2
S. comata	.6	1.2	+ .6

^{1/} Values are average sq dm per 20 sq dm plot.

Response of shrubs

The changes in shrub cover at the 26 sites is shown in Table 11. There were few shrubs other than big sagebrush or three-tip sagebrush at most of the sites. Since big sagebrush and three-tip sagebrush were the target species for control, the major reductions in shrub cover could be expected. Shrub cover was completely removed (based on these data) at six sites. Five of these sites were sprayed in 1970. The older projects had smaller reductions, indicating some shrub recovery as the years go by.

Table 12 and 13 summarize the reactions of species. Big and three-tip sagebrush consistently decreased as a result of spraying. It may be noted that several sites showing zero values for shrubs in Table 11, have been listed as "D" in Tables 12 and 13. This is due to an arbitrary decision in handling the data. Several of these sites had shrub reductions to trace amounts. Trace amounts did not contribute to the figures in Table 11. In Table 12 it was decided that the sprayed value must be zero in order to assign a "0". A trace value in the sprayed range called for a "D".

Big sagebrush did not occur on three sites. On these sites three-tip sagebrush was the target species. On four sites, both sagebrush species occurred.

Of interest is the increase of Chrysothamnus nauseosus on all sites on which it occurred and the tendency of Rosa woodsii to increase after spraying. Symphoricarpos albus was reduced at six sites and increased at one site. The reductions were to zero in three sites.

Data on big sagebrush numbers was taken at most sites while cover data were being collected. Table 14 shows the total numbers of sage-

Table 11. Quantitative differences in shrub cover between unsprayed and sprayed range on 26 sites

	SHRUBS			
	Unsprayed	Sprayed	Difference	% ^{2/} Difference
Antelope Basin #1	4.2 ^{1/}	.6	- 3.6	- 86%
#2	4.5	.1	- 4.4	- 98
#3	3.6	.1	- 3.5	- 97
Badger Pass #1	6.4	3.0	- 3.4	- 53
#2	3.1	.9	- 2.2	- 71
Beaver-Shovel #1	6.2	1.3	- 4.9	- 79
#2	4.0	.1	- 3.9	- 97
Corral Cr.	6.4	1.4	- 6.0	- 94
Cottonwood Cr. #1	5.2	1.8	- 3.4	- 65
#2	2.8	1.2	- 1.6	- 57
Coyote Cr.	6.4	0	- 6.4	- 100
Doolittle Cr.	2.0	1.6	- .4	- 20
Elk Lake	7.1	1.5	- 5.6	- 79
Headquarters	3.5	.2	- 3.3	- 94
Horse Cr. #1	7.8	.1	- 7.7	- 99
#2	6.6	.0	- 6.6	- 100
Middle Cr. #1	7.8	.9	- 6.9	- 88
#2	8.0	4.1	- 3.9	- 49
North Meadow #1	7.2	.3	- 6.9	- 96
#2	4.6	.0	- 4.6	- 100
North Saddle #1	3.2	.0	- 3.2	- 100
#2	10.9	.1	- 10.8	- 99
#3	1.8	.0	- 1.8	- 100
Salefsky	6.6	.0	- 6.6	- 100
West Fork #1	6.2	.8	- 5.4	- 87
#2	5.3	.3	- 5.0	- 94
Average	5.4	.4	- 5.0	- 93%

^{1/} Values are average sq dm per 20 sq dm plot.

^{2/} Percentage values are determined by dividing the difference values by the unsprayed range values.

Table 12. Changes in cover values of individual shrub species between unsprayed and sprayed vegetation at 26 sites.1/

SHRUBS	Antelope Basin #1	Antelope Basin #2	Antelope Basin #3	Badger Pass #1	Badger Pass #2	Beaver-Shovel #1	Beaver-Shovel #2	Corral Creek	Cottonwood #1	Cottonwood #2	Coyote Creek	Dolittle Creek	Elk Lake	Headquarters	Horse Creek #1	Horse Creek #2	Middle Creek #1	Middle Creek #2	North Meadow #1	North Meadow #2	North Saddle #1	North Saddle #2	North Saddle #3	Salefsky Creek	West Fork #1	West Fork #2
Artemisia tridentata	D O	D D		D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	O	D	D	D	D	D
A. tripartita	O O D		D	D	O								D													
Chrysothamnus viscidiflorus								D					I		D											
C. nauseosus				I		I			I																	
Rosa woodsii	O					I			I								=	I								
Symphoricarpos albus						O							I	D			O	D			O			D		
Tetradymia canescens		D	I	=	D	D		I					D													
TOTAL SHRUBS	D D D	D D	D D	D	D	D	D	D	D D	D	D	D	D	D	D D	D D	D D	D D	D D	D D	D D	D	D	D	D	

- 1/ I = Sprayed value increased by at least 0.1 sq dm from unsprayed value.
 D = Sprayed value decreased by at least 0.1 sq dm from unsprayed value.
 O = Unsprayed value at least 0.1 sq dm and sprayed value 0.0
 = = Unsprayed value at least 0.1 sq dm and equal to sprayed value.

Only species yielding data from 3 or more sites are included in the table.

Table 13. Summary of numbers of sites at which shrub species increased, decreased, or did not change as a result of spraying for sagebrush control.

SHRUBS	Number of sites with increased cover on sprayed range	Number of sites with decreased cover on sprayed range	Number of sites with no change	Number of sites species occurs as traces or not occurring
<i>Artemisia tridentata</i>	0	23	0	3
<i>A. tripartita</i>	0	7	0	19
<i>Chrysothamnus viscidiflorus</i>	1	2	0	23
<i>C. nauseosus</i>	3	0	0	23
<i>Rosa woodsii</i>	3	1	1	21
<i>Symphoricarpos albus</i>	1	6	0	19
<i>Tetradymia canescens</i>	2	4	1	19
TOTAL SHRUBS	0	26	0	0

Table 14. Total numbers of big sagebrush plants found in transects of 50 4x5 dm plots. Only sagebrush plants with the ground level cross section fully within the plots were counted.
(Data were not collected at some sites.)

Sites	Sagebrush plants in plots used to sample vegetational cover at sites				Sagebrush plants in plots on transects within the spray project		
	Unsprayed		Sprayed		Transect No.	Pre-spray age	Post-spray age
	Pre-spray ^{1/} age	Post-spray ^{1/} age	Pre-spray age	Post-spray age			
Antelope Basin #1	10	5	3	1	1	2	4
#2	5	8	0	0	2	1	6
#3	36	28	0	15			
Badger Pass #1	3	13	9	12	1	10	15
#2 ^{2/}	6	8	2	3	2	8	18
					3	3	31
					1	2	8
Beaver-Shovel #2	22	21	0	7	2	2	9
					1	3	7
Cottonwood #2	1	13	1	10	2	3	2
					3	1	3
Coyote Cr					1	0	10
					2	1	8
Doolittle	8	7	4	27	1	2	8
					2	2	16
Headquarters Horse Cr	3	14	0	10			
					1	1	1
					2	0	7
					3	0	0
Middle Cr #2	2	7	0	6			
North Saddle #1	10	24	0	0	1	0	0
#2	17	8	0	9	2	2	22
#3	7	2	2	2	3	2	5
Salefsky	10	2	0	1	1	2	3
					2	5	4
West Fork #1	2	0	2	2	1	2	1
#2	9	13	1	0	2	1	4

^{1/} Pre-spray: Sagebrush plants older than the age of the spray project. Post-spray: Sagebrush plants establishing in the year of the spraying and later.

^{2/} The cover sample in this site had 25 plots, rather than 50 plots because livestock started using the area before the 50-plot sample could be taken. The transects within the project were 50-plot samples.

brush plants counted on 50 plots. (For those interested, numbers of plants in 50 plots $\times .086$ = numbers of plants per sq yd.) The plants were aged to determine whether or not the plants established prior to or after spraying.

In addition, transects of 50 4x5 dm plots were located within the spray project solely for sagebrush counts. The last three columns of Table 14 show results from these transects.

First, it is clear that young sagebrush plants are common in unsprayed stands. Aging revealed that most of the very young sagebrush plants in the unsprayed areas germinated the year of the analysis of a site. Very few were more than one year old, indicating that competition in an established sagebrush stand does not permit establishment of most new sagebrush plants.

It was most common for the post-spray age plants on the sprayed areas to show establishment the year of spraying or the year following.

The pre-spray age plants on the sprayed areas most commonly aged one to two years prior to the spraying. It is postulated that these were small plants under grass or forb cover where the spray could not reach them directly. These plants thus were able to survive.

In the transects within the project, the pre-spray ages tended to be within three years prior to the spraying. Only two sites had no sagebrush occurring in the plots. Both of these were 1970 projects.

It is evident that spraying does not usually destroy sagebrush completely. In most cases some new plants will become established following spraying or some small plants established prior to treatment will survive spraying.

Production response

It was pointed out in the methodology section that due to 1) time and 2) fairly high cover/weight correlations, the collection of production data was not continued in the third year.

The production data which were collected are summarized in Table 15. The production of individual species can be obtained from the appendix tables.

The production responses are very similar to the cover responses (Figure 2). The average grass production for all sites combined was approximately doubled by spraying. The average forb production was reduced about 30 percent.

The responses by sites were quite variable. One site, Coyote Creek, had essentially no change in grass production, while North Meadow #1 had a three-fold increase.

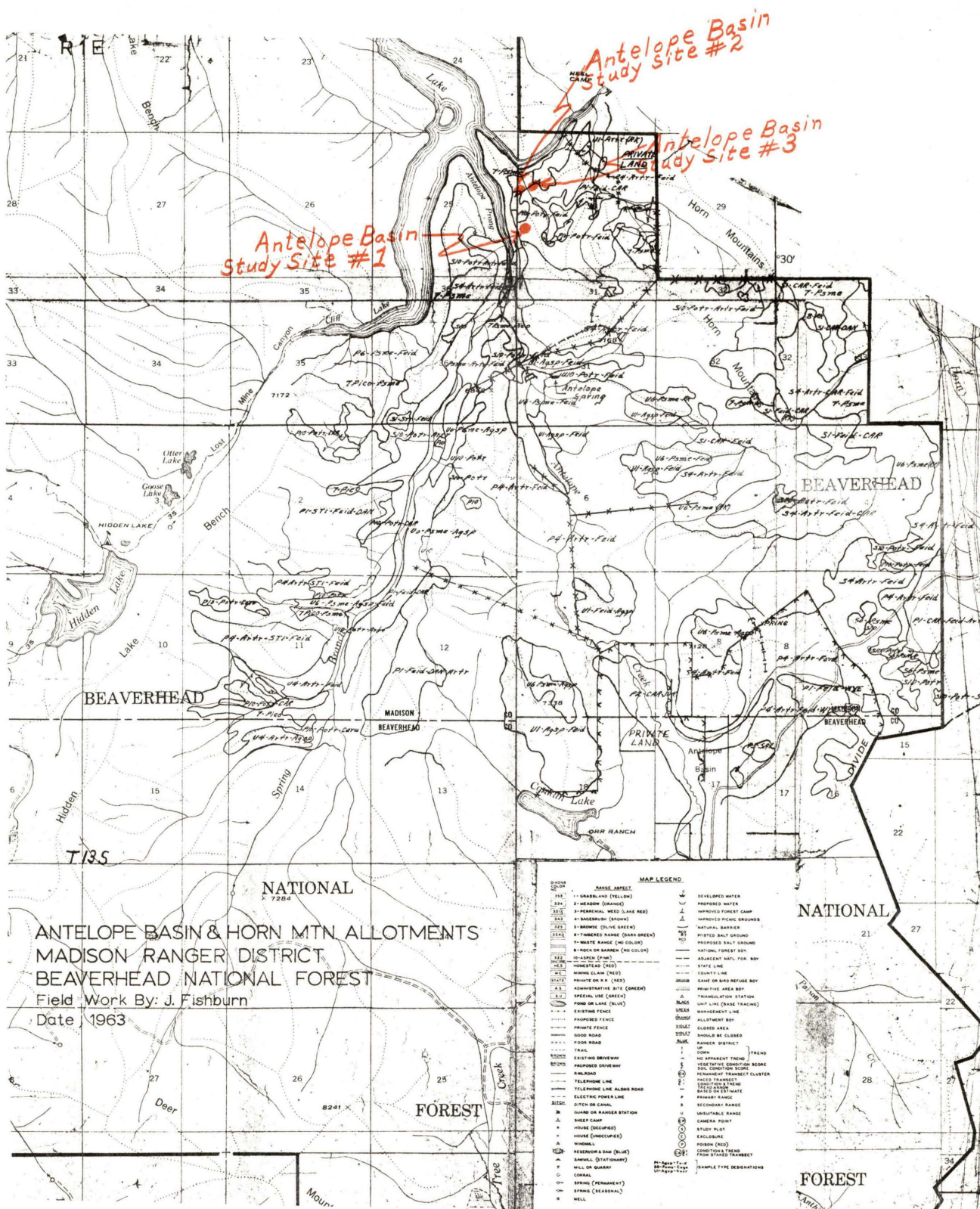
Again, it is pointed out that production cannot be compared among sites due to the varying stages of plant growth at which sites were sampled. For the same reason these figures cannot be used to indicate possible stocking rate of a site unless the sampling was late in the growing season.

Table 15. Average production in grams per 20 sq dm plot on sites sampled in 1970 and 1971.

Site	Date of Sampling	Grasses and Sedges		FORBS	
		Unsprayed	Sprayed	Unsprayed	Sprayed
Corral Cr.	Aug. 14, 1970	18.61	30.31	11.37	6.28
Coyote Cr.	July 10, 1971	16.14	16.85	10.62	6.35
Elk Lake	July 15, 1971	11.21	17.76	9.19	4.57
Horse Cr. #1	July 1, 1971	8.15	22.96	1.57	6.46
Horse Cr. #2	June 25, 1971	7.92	20.13	3.83	1.62
Middle Cr. #1	July 31, 1970	17.65	33.66	6.84	3.16
North Meadow #1	Aug. 7, 1971	11.89	38.23	17.75	9.52
North Meadow #2	Aug. 12, 1971	12.80	33.81	15.05	13.66
AVERAGE		13.05	26.71	9.53	6.45

NOTE: gms/plot X 44.6 = lbs/acre

APPENDIX



ANTELOPE BASIN

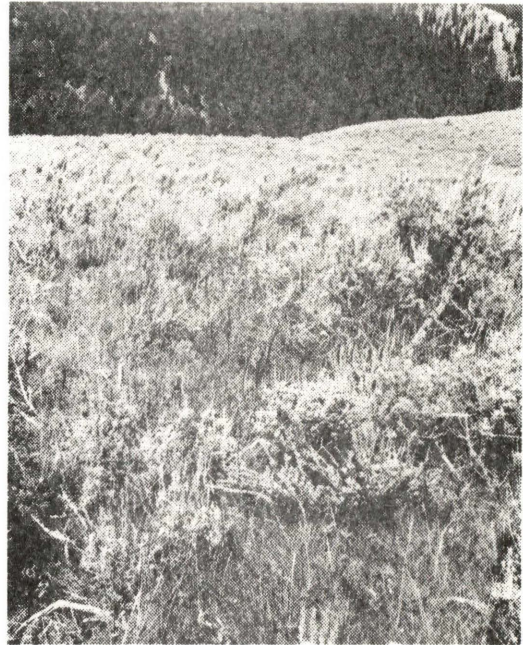
SITE NO. 1

Location: S30 T12S R2E

Soil: Clay loam, very stony
below 15 inches. pH 6.5

Sprayed: 1970

Sampled: July 5-7, 1972



General view

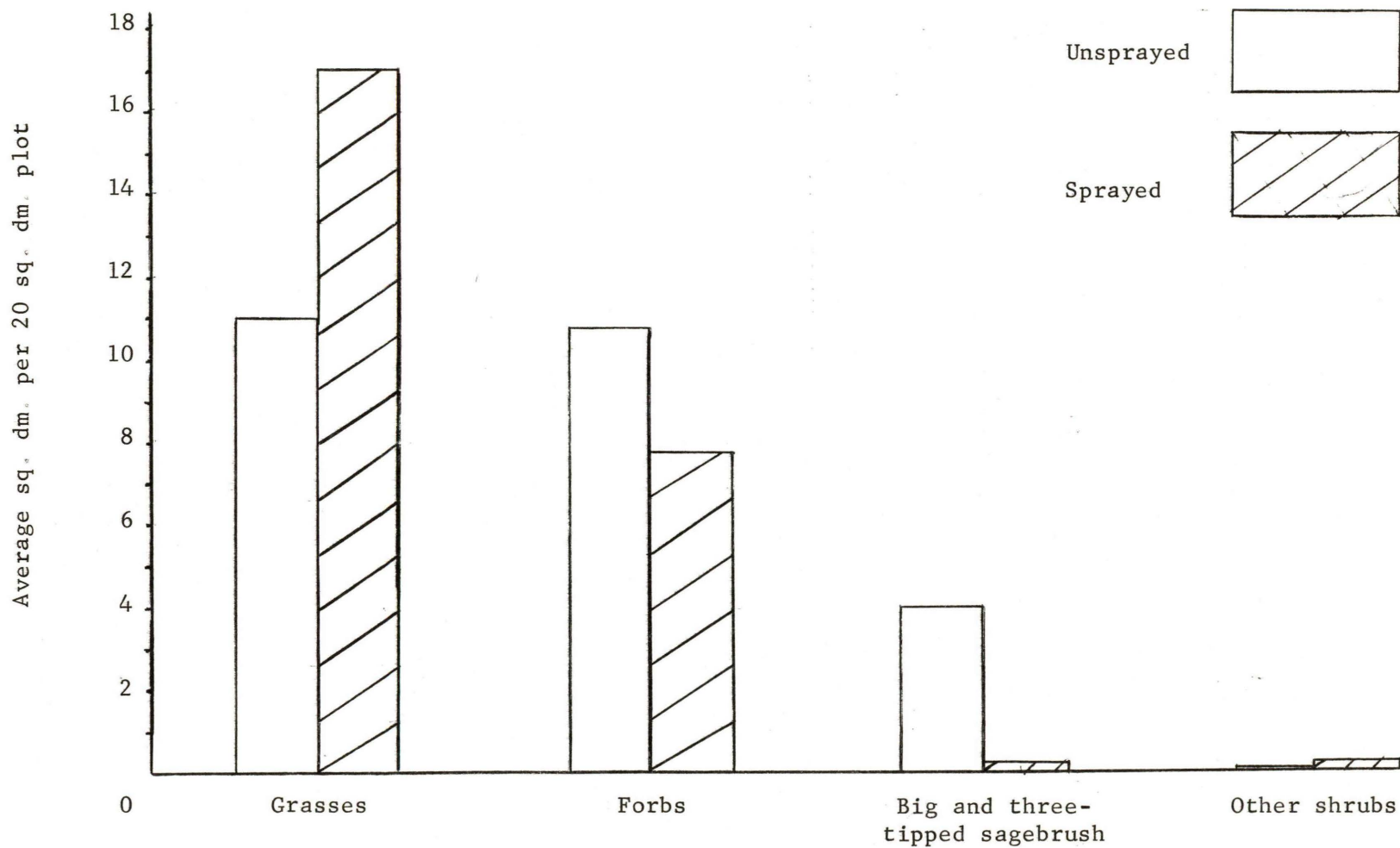


Unsprayed



Sprayed

Cover data for vegetation groupings on unsprayed and sprayed vegetation at Antelope Basin, Site 1. Sprayed 1970. Sampled July 5-6, 1972.



Cover data for Antelope Basin, Site 1, comparing unsprayed and sprayed (1970) vegetation. Sampled July 5-6, 1972.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Agropyron smithii			T	
A. spicatum	1.2	5	1.3	5
Bromus inermis			.3	1
B. marginatus	.6	2	.4	2
Carex spp.	.6	2	1.2	5
Danthonia intermedia	.7	3	.1	
Festuca idahoensis	3.1	12	6.6	26
Koeleria cristata	.5	2	1.0	4
Poa sp.	.2	1	2.1	8
Stipa comata	4.1	16	3.9	15
TOTAL GRASSES AND SEDGES	11.0	42	17.1	67
Achillea millefolium	.8	3	.6	2
Agoseris glauca	.3	1	.2	1
Anaphalis margaritacea			T	
Antennaria rosea	.2	1	T	
Campanula rotundifolia	.1		T	
Cerastium nutans	T			
Cirsium vulgare	.2	1		
Clematis hirsutissima	.2	1	.3	1
Collomia linearis	.1		T	
Dodecatheon conjugens	T		T	
Erigeron alpinus	.4	1	.1	
E. compositus	.1		T	
Fragaria virginiana	.6	2	1.4	5
Galium boreale	.3	1	T	
Geranium viscosissimum	3.5	13	2.8	11
Geum triflorum	.2	1	.2	1
Helianthus annuus	T			
Heuchera parviflora	.1		.2	1
Lappula redowskii	.2	1	.1	
Linum perenne			.1	
Lomatium triternatum	T			
Lupinus spp.	1.4	5	.5	2
Mertensia oblongifolia	T			
Microseris nutans	T		T	
Potentilla arguta	.5	2	T	
P. gracilis	.2	1	.4	2
Ranunculus glaberrimus	T		T	
Rumex paucifolius	.1		.4	2
Senecio integerrimus	T			
Sophia filipes	T		T	
Taraxacum laevigatum	.9	3	.4	2

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Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Viola nuttallii	.1		T	
(Total forb traces)	<u>(.2)</u>	<u>(1)</u>	<u>(.2)</u>	<u>(1)</u>
TOTAL FORBS	10.7	41	7.9	31
Artemisia ludoviciana	.1		.3	1
A. tridentata	3.8	15	.3	1
A. tripartita	<u>.3</u>	<u>1</u>	<u>—</u>	<u>—</u>
TOTAL SHRUBS	4.2	16	.6	2

ANTELOPE BASIN

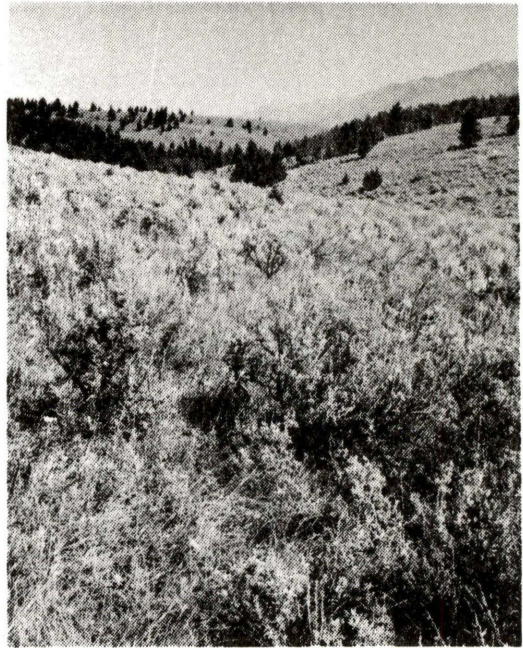
SITE NO. 2

Location: S30 T12S R2E

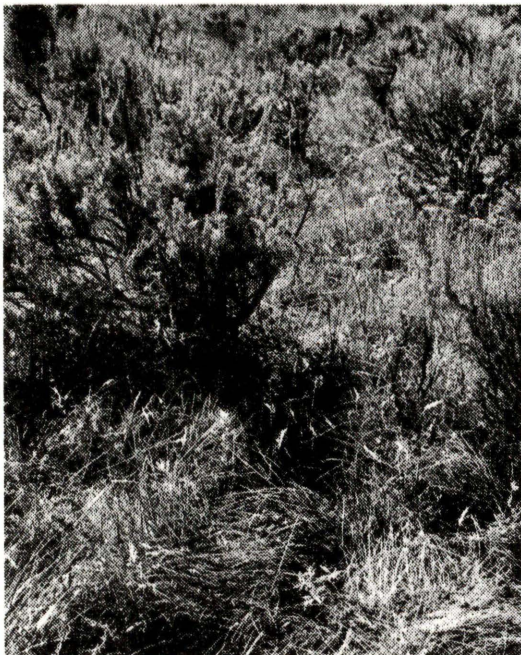
Soil: Sandy loam, very stony
below 20 inches. pH 6.5

Sprayed: 1970

Sampled: June 29-30, 1972



General view

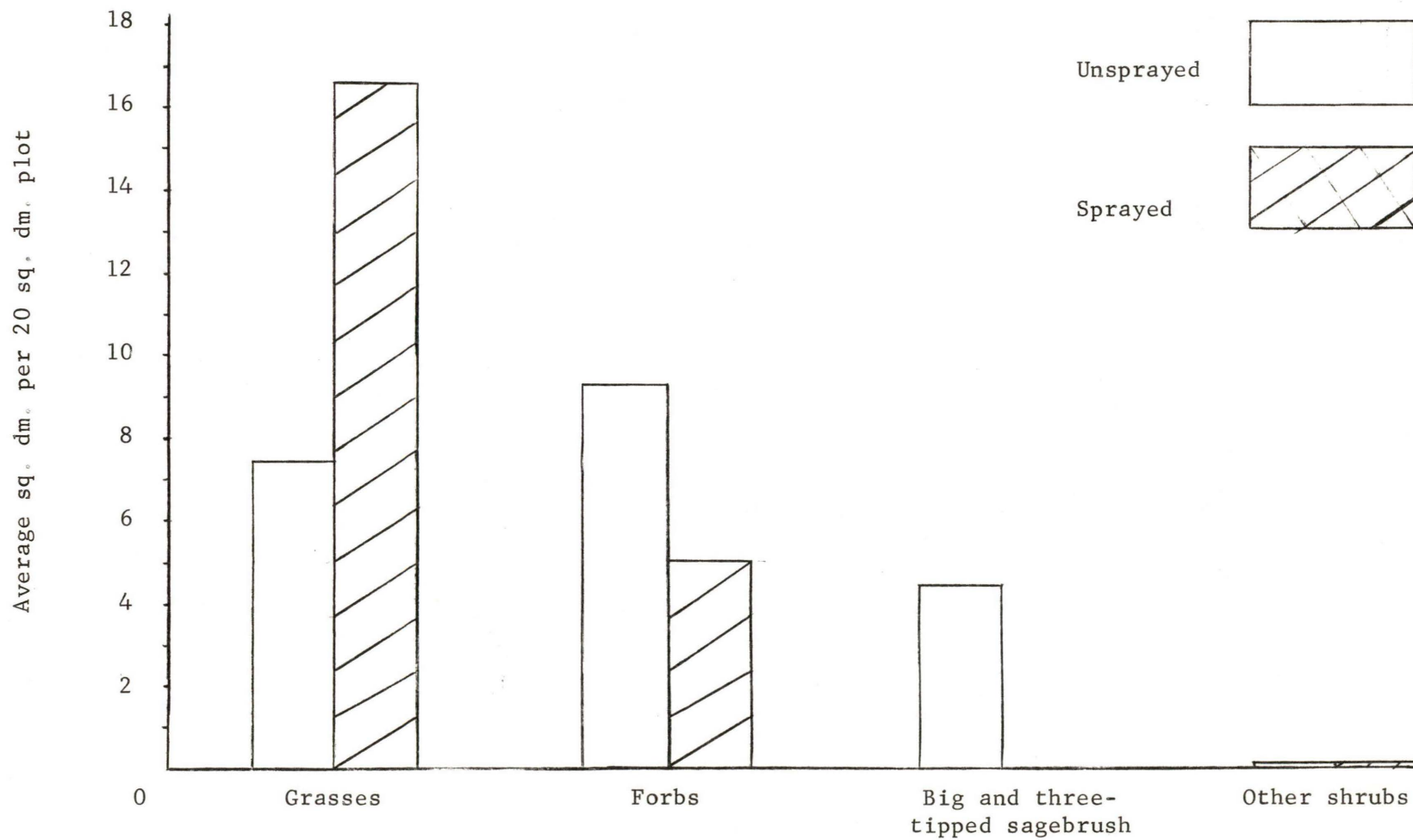


Unsprayed



Sprayed

Cover data for vegetation groupings on unsprayed and sprayed vegetation at Antelope Basin, Site 2. Sprayed 1970. Sampled June 30, 1972.



Cover data for Antelope Basin, Site 2, comparing unsprayed and sprayed (1970) vegetation. Sampled June 30, 1972.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Agropyron spicatum	1.2	6	2.9	13
Bromus inermis			.5	2
B. marginatus	.4	2	.5	2
Carex spp.	.7	3	1.3	6
Danthonia intermedia	.2	1	.6	3
D. unispicata	.1		T	
Festuca idahoensis	2.8	13	5.3	24
Koeleria cristata	.3	1	1.7	8
Poa sp.	1.0	5	.7	3
Stipa columbiana	.8	4		
S. comata			3.0	14
TOTAL GRASSES AND SEDGES	7.5	35	16.6	76
Achillea millefolium	1.1	5	1.1	5
Agoseris glauca	.3	1	T	
Allium cernuum			T	
Anaphalis margaritacea	T			
Antennaria rosea	.1		T	
Arabis holboellii	T		T	
Arenaria congesta	.3	1	.4	2
Arnica fulgens	.1		T	
Astragalus miser	.3	1	.1	
Besseyia wyomingensis	.1		T	
Cerastium arvense			T	
C. nutans			.2	1
Clematis hirsutissima	T			
Collinsia parviflora	T			
Collomia linearis			.1	
Delphinium bicolor	T		T	
Dodecatheon conjugens	.2	1	.2	1
Erigeron alpinus	.5	2	.2	1
Erysimum sp.	.1			
Fritillaria atropurpurea	T			
Galium boreale			T	
Geranium viscosissimum	2.4	11	.8	4
Geum triflorum	.5	2		
Helianthus annuus	T		T	
Lomatium triternatum	T		T	
Lupinus spp.	.9	4	.4	2
Mertensia oblongifolia			T	
Microseris nutans			T	
Phlox longifolia	.1		.1	
Potentilla arguta	.1			
P. gracilis	.2	1		

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Species	UNSPRAYED		SPRAYED	
	Ave. sq dm	Percent of	Ave. sq dm	Percent of
	per 20 sq dm	total veg.	per 20 sq dm	total veg.
	plot	cover	plot	cover
		%		%
Ranunculus glaberrimus	.1			
Rumex paucifolius	T		T	
Senecio canus	T			
Taraxacum laevigatum	1.5	7	1.2	5
Viola nuttallii	.1			
Zygadenus venenosus	.1		T	
(Total forb traces)	(.2)	(1)	(.2)	(1)
TOTAL FORBS	9.3	44	5.0	23
Artemisia tridentata	4.2	20		
A. tripartita	.2	1		
Juniperus communis			.1	
Rosa woodsii	.1			
TOTAL SHRUBS	4.5	21	.1	
Bare ground	.1		.1	

ANTELOPE BASIN

SITE NO. 3

Location: S30 T12S R2E

Soil: Fine sandy loam, very stony
below 10 inches

Sprayed: 1970

Sampled: July 25-26, 1972



General view

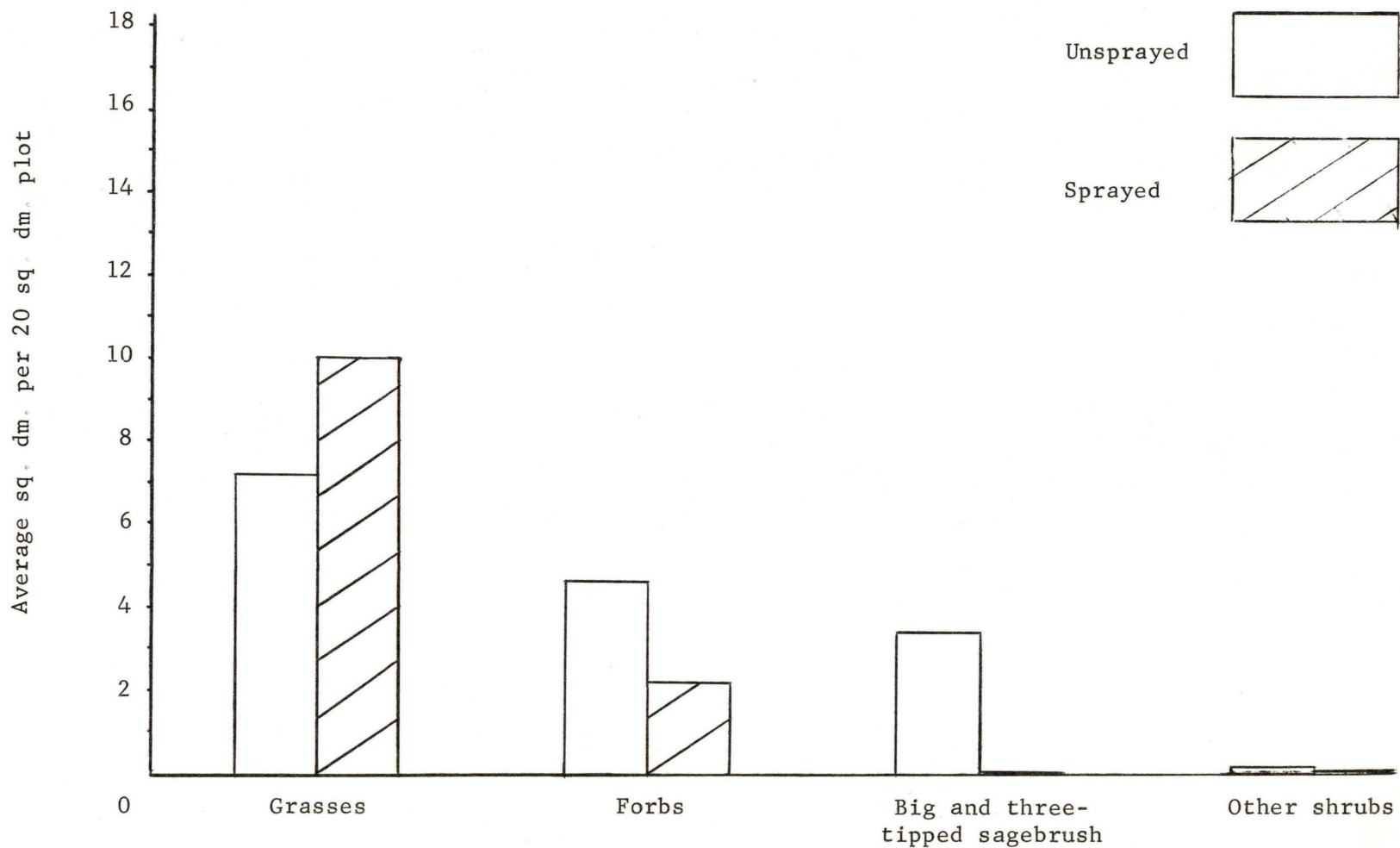


Unsprayed



Sprayed

Cover data for vegetation groupings on unsprayed and sprayed vegetation at Antelope Basin, Site 3. Sprayed 1970. Sampled July 25-26, 1972.



Cover data for Antelope Basin, Site 3, comparing unsprayed and sprayed (1970) vegetation. Sampled July 25-26, 1972.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Agropyron riparium	.5	3	.3	2
A. spicatum	.2	1	.8	6
Bromus marginatus	.2	1		
Carex spp.	T		.1	1
Festuca idahoensis	5.3	34	6.3	51
Koeleria cristata	.2	1	.9	7
Poa sp.	.2	1	.3	2
Stipa columbiana	.2	1	.1	1
S. comata	.3	2	1.1	9
TOTAL GRASSES AND SEDGES	7.2	46	10.0	81
Achillea millefolium	.5	3	.2	2
Agoseris glauca	.4	3	T	
Antennaria rosea	.7	4	.3	2
Arabis holboellii	.1	1	T	
Arenaria congesta	T		T	
Arnica fulgens	.1	1	T	
Astragalus miser			.5	5
Castilleja flava	T			
Cerastium nutans	T		T	
Collinsia parviflora	T		.1	1
Crepis acuminata	T			
Delphinium bicolor			T	
Dodecatheon conjugens			T	
Erigeron alpinus			T	
Erigeron sp.	.2	1		
Geranium viscosissimum	T			
Heuchera parviflora	T			
Lupinus spp.	1.8	12	.6	5
Microseris nutans	.1	1	T	
Phlox hoodii	T		T	
Taraxacum laevigatum	.4	3	.3	2
Tragopogon dubius	.1	1		
Viola nuttallii	T		T	
(Total forb traces)	(.3)	(2)	(.2)	(1)
TOTAL FORBS	4.7	30	2.2	18
Artemisia tripartita	3.4	22	T	
Chrysothamnus nauseosus	T			
Tetradymia canescens	.2	1	T	
TOTAL SHRUBS	3.6	23	.1	1

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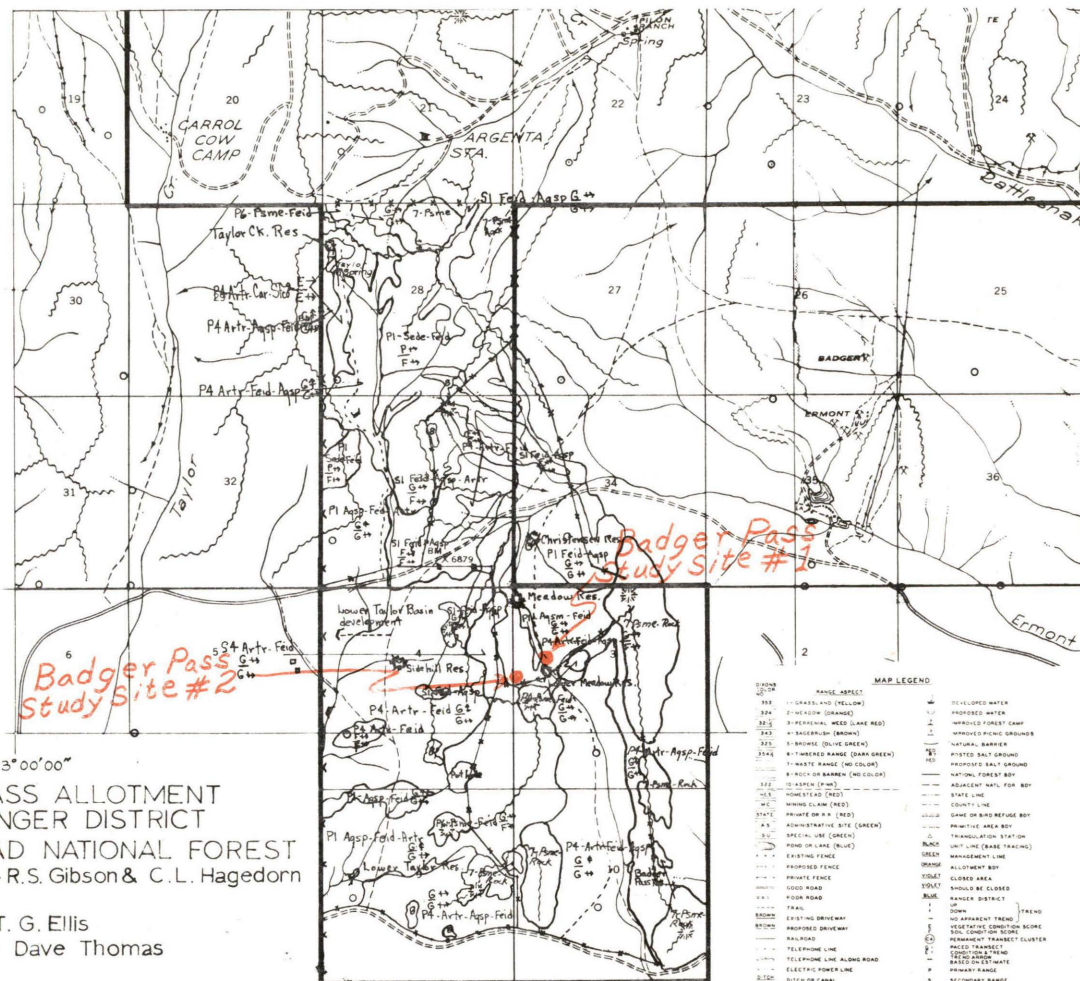
Species	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Bare ground	.2		.4	

T.6 S.
LINE-24(Ro11-2B)0

T.7 S.
45° 15'
LINE-25(Ro11-2B)0
113° 00' 00"

BADGER PASS ALLOTMENT
DILLON RANGER DISTRICT
BEAVERHEAD NATIONAL FOREST
Field Work By- R.S. Gibson & C.L. Hagedorn
Date: 1959
Revised-1961- T. G. Ellis
1972- Dave Thomas

FOREST SERVICE MAP CLASS C
Prepared by U.S. Forest Service, Missoula, Montana 1950



R.H.W.

BADGER PASS

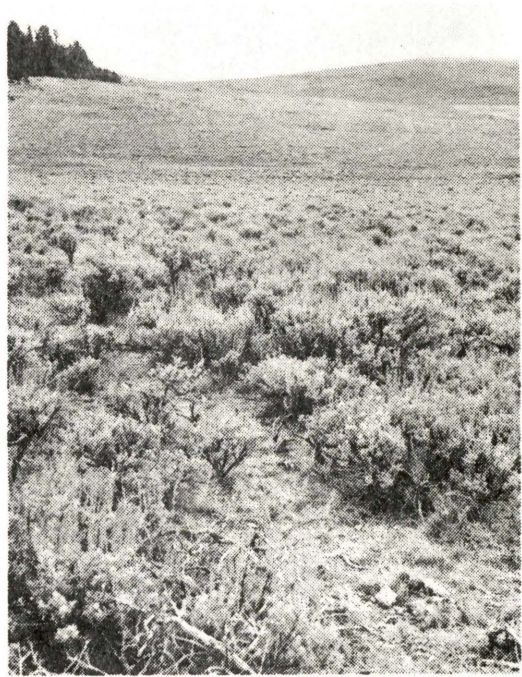
SITE NO. 1

Location: S3 T7S R11W

Soil: Stony coarse sandy loam,
very stony below 20 inches.
pH 6.0

Sprayed: 1963

Sampled: June 1-2, 1972



General view

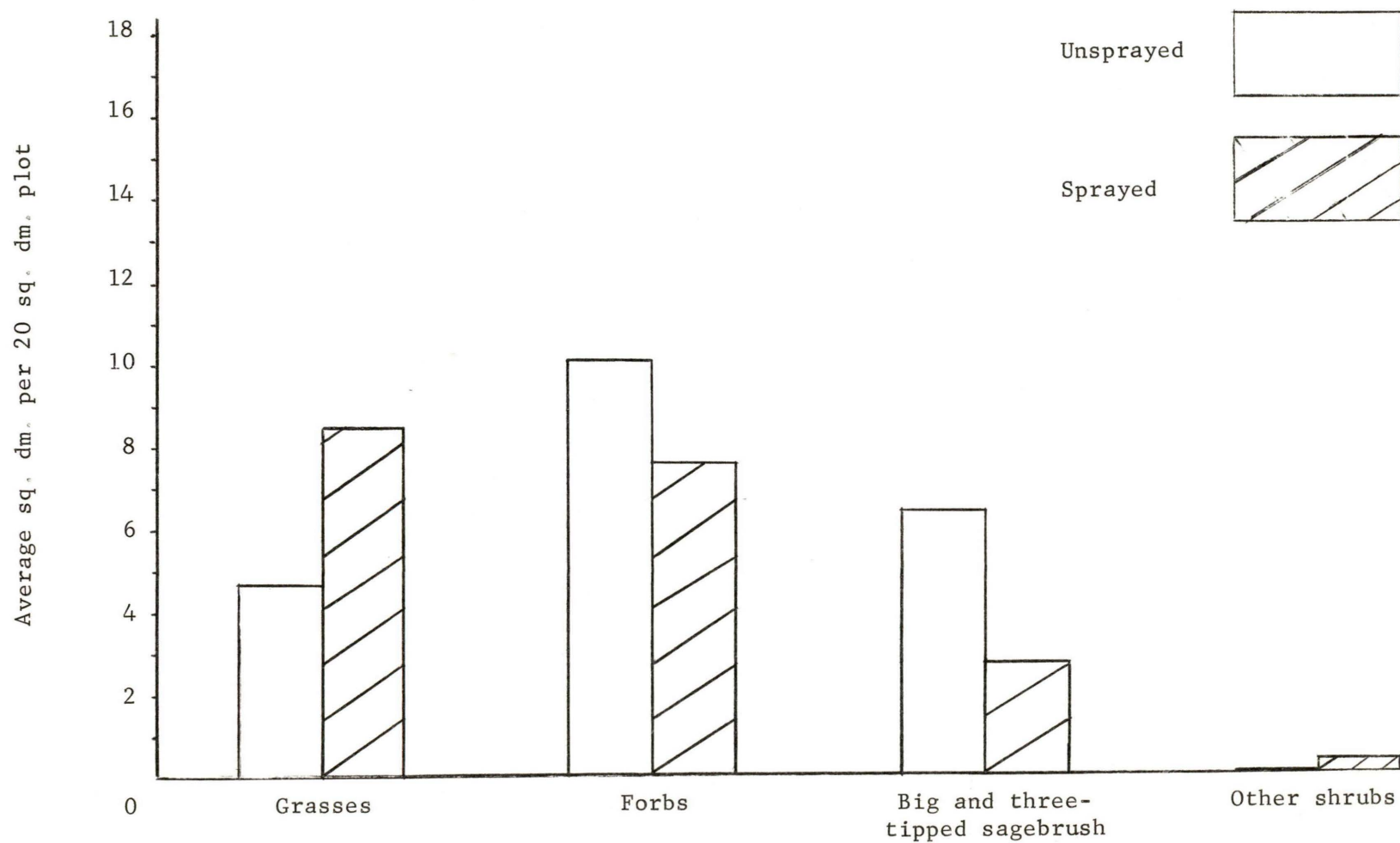


Unsprayed



Sprayed

Cover data for vegetation groupings on unsprayed and sprayed vegetation at Badger Pass, Site 1. Sprayed 1963. Sampled June 1-2, 1972.



Cover data for Badger Pass, Site 1, comparing unsprayed and sprayed
(1963) vegetation. Sampled June 1-2, 1972.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Agropyron spicatum	.4	2	1.1	6
Festuca idahoensis	3.6	17	6.1	32
Koeleria cristata	T		.1	
Poa sp.	.7	3	1.1	6
TOTAL GRASSES AND SEDGES	4.7	22	8.4	44
Achillea millefolium	.3	1	1.5	8
Agoseris glauca	.1		.2	1
Antennaria rosea	.1		.5	3
Arabis holboellii	.1		T	
Arenaria congesta			T	
Arnica fulgens	1.1	5	1.2	6
Astragalus inflexus	.1		.4	2
Besseyia wyomingensis	T			
Castilleja flava	.2	1	T	
Crepis acuminata			T	
Dodecatheon conjugens	.2	1	.1	
D. jeffreyi	T		T	
Draba nemorosa	T			
Geum triflorum	T			
Lomatium triternatum	.1		.1	
Lupinus sericeus	6.1	29	1.6	8
Mertensia longifolia	.4	2	.3	2
M. oblongifolia	.1		T	
Phlox longifolia	.2	1	1.1	6
Senecio canus	.8	4	.3	2
Taraxacum laevigatum	T		.1	
(Total forb traces)	(.1)		(.1)	
TOTAL FORBS	10.0	47	7.5	40
Artemisia tridentata	6.4	30	2.7	14
Chrysothamnus nauseosus	T		.1	
Juniperus communis			T	
Tetradymia canescens			.1	
TOTAL SHRUBS	6.4	30	3.0	16
Moss	T		T	
Bare ground	T		.2	

BADGER PASS

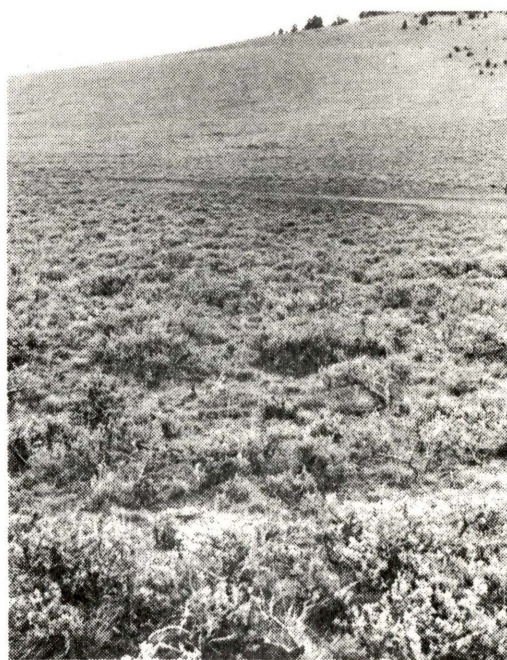
SITE NO. 2

Location: S3 T7S R11W

Soil: Coarse sandy loam, rock
outcroppings common,
average maximum depth of
soil about 10 inches.

Sprayed: 1963

Sampled: June 6-9, 1972



General view

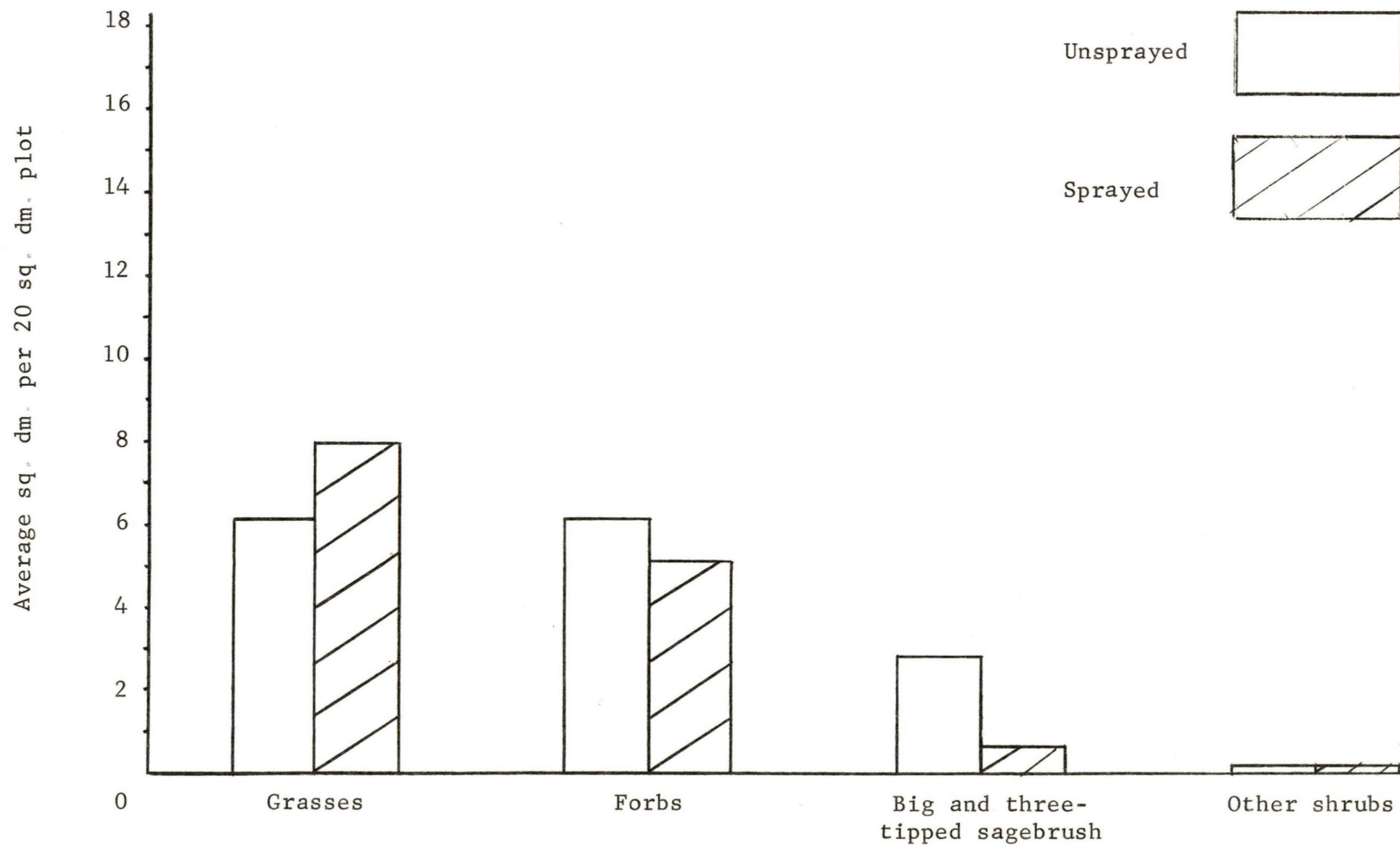


Unsprayed



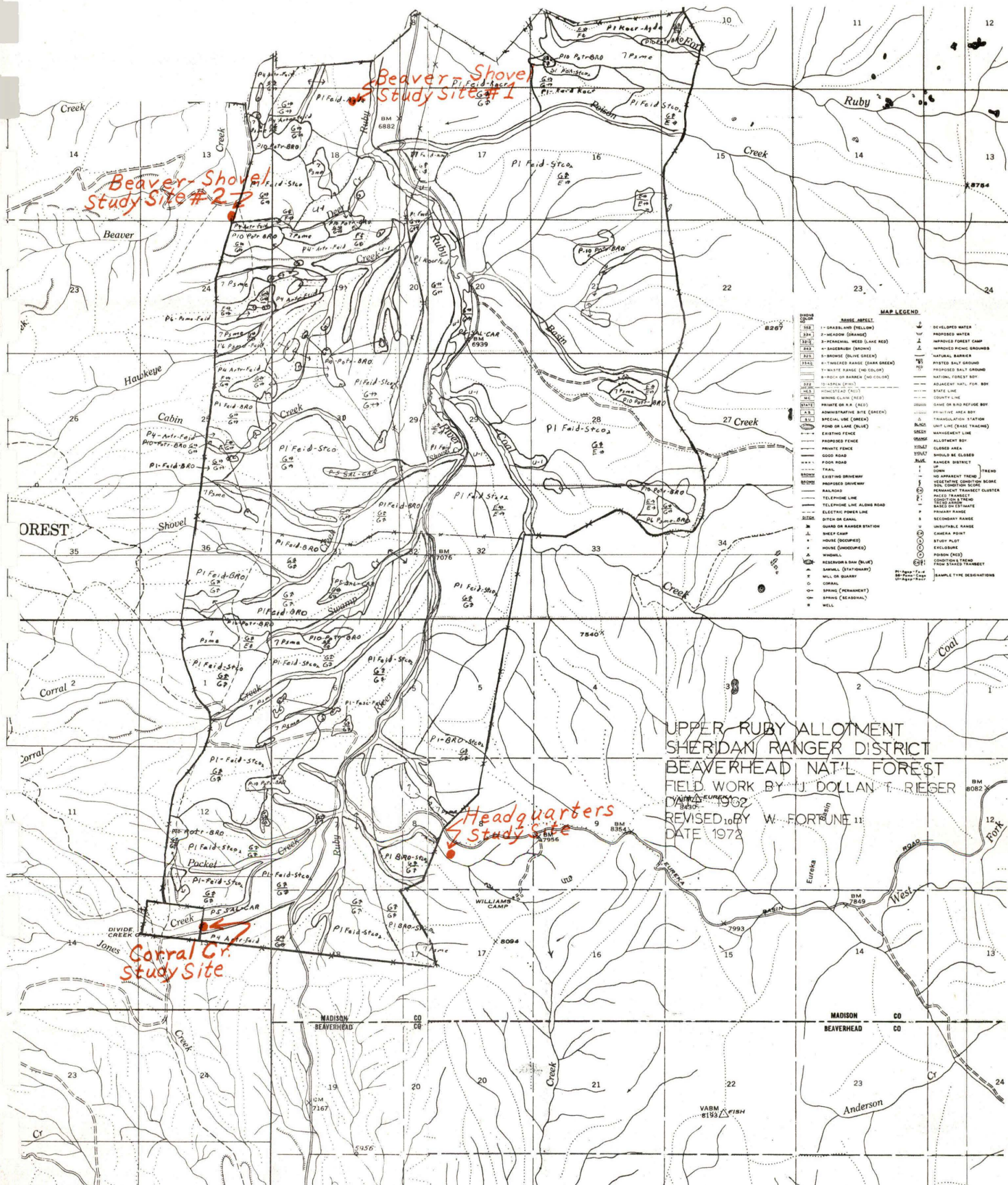
Sprayed

Cover data for vegetation groupings on unsprayed and sprayed vegetation at Badger Pass, Site 2. Sprayed 1963. Sampled June 6-9, 1972.



Cover data for Badger Pass, Site 2, comparing unsprayed and sprayed
(1963) vegetation. Sampled June 6-9, 1972.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Agropyron spicatum	.2	1	.7	5
Festuca idahoensis	5.0	33	6.7	48
Koeleria cristata	T		T	
Poa sp.	.9	6	.4	3
TOTAL GRASSES AND SEDGES	6.1	40	7.9	57
Achillea millefolium	.6	4	.5	4
Agoseris glauca	.1	1	T	
Anaphalis margaritacea	T			
Antennaria rosea	1.4	9	2.4	17
Arabis holboellii	.1	1	.1	1
Arenaria congesta	.4	3		
Arnica fulgens	.3	2	.2	1
Astragalus miser	.2	1	.3	2
Castilleja flava	.1	1	.1	1
Crepis acuminata	T		T	
Cymopterus bipinnatus			T	
Dodecatheon jeffreyi	T			
Erigeron compositus	T		T	
Geum triflorum	T			
Heuchera parviflora	T			
Lomatium triternatum	.1	1	T	
Lupinus sericeus	1.7	11	.1	1
Mertensia longifolia	.1	1	T	
M. oblongifolia	.1	1	T	
Phlox longifolia	.4	3	1.0	7
Sedum stenopetalum	.3	2	.2	1
Taraxacum laevigatum			T	
(Total forb traces)	(.2)	(1)	(.2)	(1)
TOTAL FORBS	6.1	40	5.1	37
Artemisia tridentata	2.2	14	.7	5
A. tripartita	.7	5	T	
Chrysothamnus nauseosus	T		T	
Tetradymia canescens	.1	1	.1	1
TOTAL SHRUBS	3.1	20	.9	6
Moss	T			
Bare ground	1.8		2.6	



MAP LEGEND	
1-3	ROADS (YELLOW)
4-6	PROPOSED WATER
7-9	PROPOSED FOREST CAMP
10-12	PROPOSED POND (SHADERS)
13-15	NATURAL BARRIER
16-18	PI FELD-STCO
19-21	PI FELD-STCO
22-24	PI FELD-STCO
25-27	PI FELD-STCO
28-30	PI FELD-STCO
31-33	PI FELD-STCO
34-36	PI FELD-STCO
37-39	PI FELD-STCO
40-42	PI FELD-STCO
43-45	PI FELD-STCO
46-48	PI FELD-STCO
49-51	PI FELD-STCO
52-54	PI FELD-STCO
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BEAVER-SHOVEL

SITE NO. 1

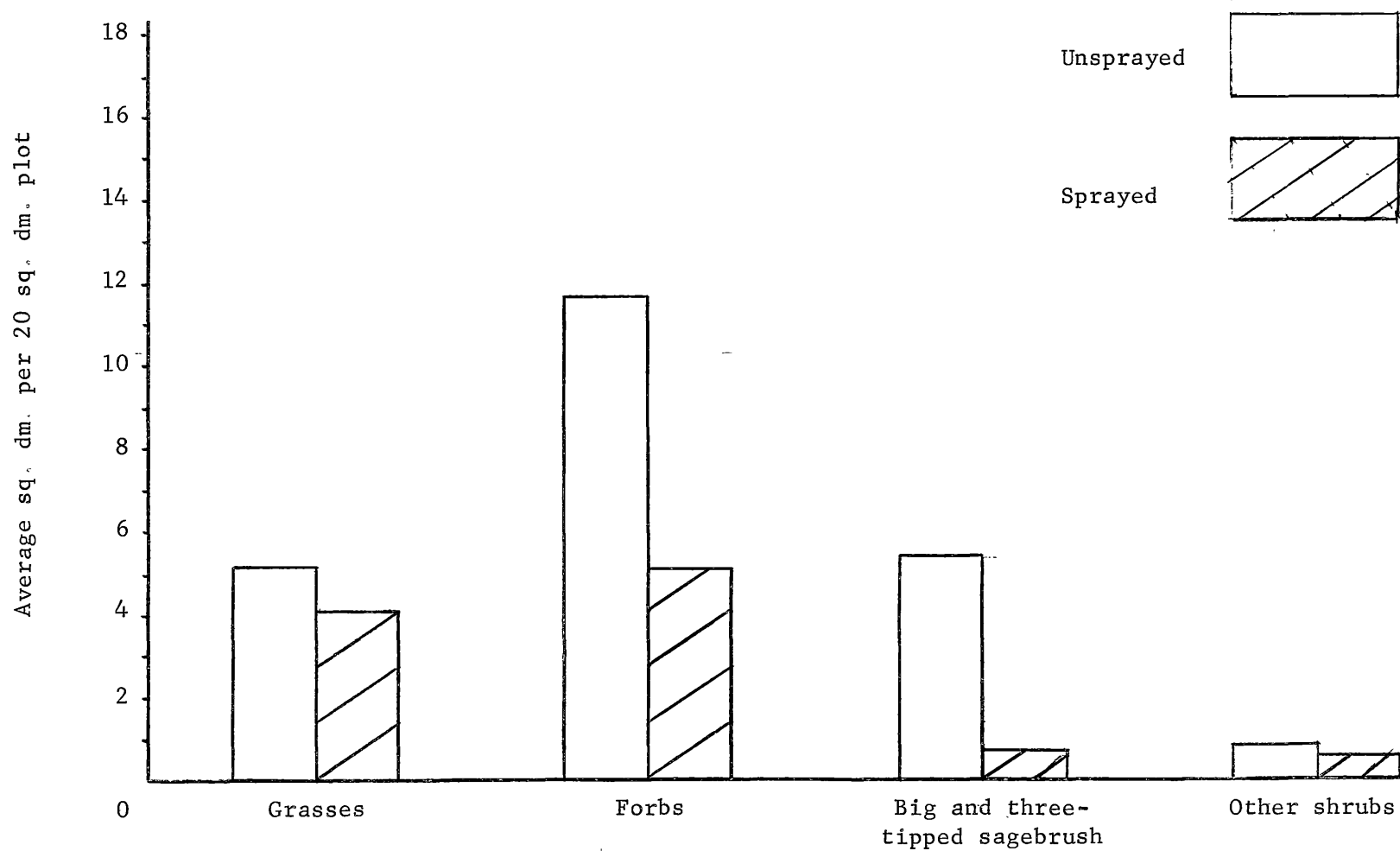
Location: S18 T11S R3W

Soil: 12 inches sandy loam (pH 6.75)
overlying white silty base.

Sprayed: 1970

Sampled: July 13-17, 1972

Cover data for vegetation groupings on unsprayed and sprayed vegetation at Beaver-Shovel, Site 1. Sprayed 1970. Sampled July 13-18, 1972.



Cover data for Beaver-Shovel, Site 1, comparing unsprayed and sprayed (1970) vegetation. Sampled July 13-18, 1972.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Agropyron smithii	1.8	8	1.5	14
Carex spp.	T		T	
Danthonia intermedia	T			
Festuca idahoensis	2.1	9	1.8	17
Koeleria cristata	.4	2	.4	4
Poa sp.	.6	3	.2	2
Stipa comata	.2	1	.2	2
TOTAL GRASSES AND SEDGES	5.2	23	4.1	39
Achillea millefolium	.1		.1	1
Agoseris glauca			T	
Allium textile			T	
Antennaria rosea	2.1	9	1.0	9
Arabis holboellii	T		T	
A. nuttallii	T			
Arenaria congesta	T			
Arnica fulgens	.2	1		
Astragalus miser	.5	2	.3	3
Castilleja flava	T		T	
Cerastium nutans	.1			
Clematis hirsutissima	T			
Collomia linearis	T			
Crepis acuminata	T			
Draba nemorosa	T			
Erigeron sp.	.1		T	
Fragaria virginiana	T			
Fritillaria sp.	.1		T	
Galium boreale	.1			
Geranium viscosissimum	.1			
Geum triflorum	.3	1		
Heuchera parviflora	T			
Lupinus spp.	5.0	22	.6	6
Orthocarpus luteus	T			
Penstemon aridus	T			
Phlox hoodii	1.5	6	2.0	19
P. longifolia	T			
Potentilla gracilis	T			
Rumex paucifolius	T			
Taraxacum laevigatum	.9	4	.9	8
Thalictrum occidentale			T	
Viola nuttallii	.2	1	T	
Zygadenus venenosus	T			
(Total forb traces)	(.3)	(1)	(.2)	(2)
TOTAL FORBS	11.6	50	5.1	49

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Species	UNSPRAYED		SPRAYED	
	Ave. sq dm	Percent of	Ave. sq dm	Percent of
	per 20 sq dm	total veg.	per 20 sq dm	total veg.
	plot	cover	plot	cover
		%		%
Artemisia tripartita	5.3	23	.7	7
Chrysothamnus nauseosus	.1		.2	2
Eurotia lanata			T	
Symphoricarpos albus	T			
Tetradymia canescens	.7	3	.3	3
TOTAL SHRUBS	6.2	27	1.3	12
Bare ground	.1		2.4	

BEAVER-SHOVEL

SITE NO. 2

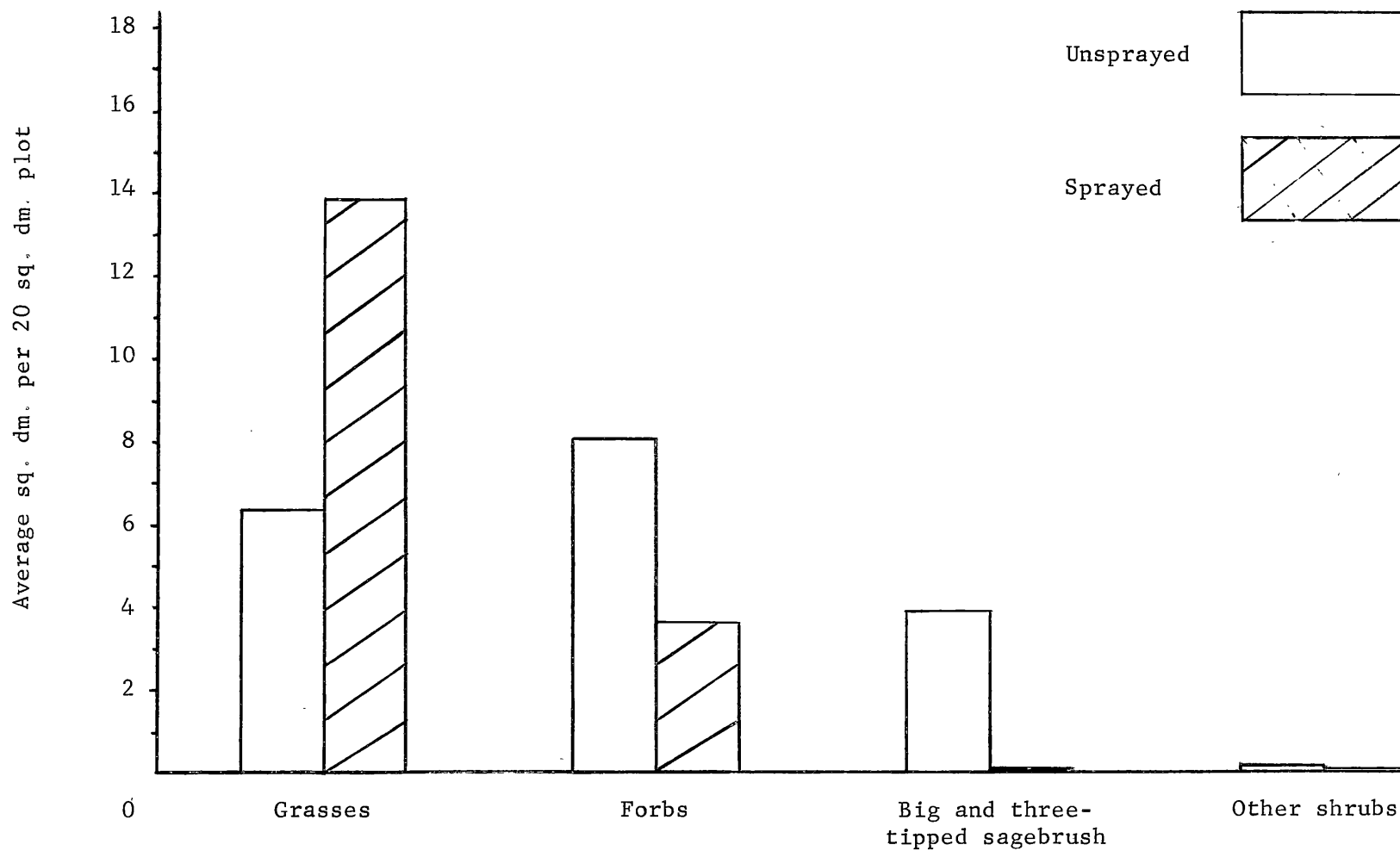
Location: S13 T11S R4W

Soil: Sandy clay (pH 6.5) overlying
sandy loam at 15-18 inches.

Sprayed: 1970

Sampled: July 18-24, 1972

Cover data for vegetation groupings on unsprayed and sprayed vegetation at Beaver-Shovel, Site 2. Sprayed 1970. Sampled July 17-24, 1972.



Cover data for Beaver-Shovel, Site 2, comparing unsprayed and sprayed (1970) vegetation. Sampled July 17-24, 1972.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Agropyron smithii	1.1	6	1.3	7
Bromus marginatus	.2	1	.3	2
Carex spp.	.3	2	.4	2
Danthonia intermedia	.3	2	.2	1
Festuca idahoensis	3.8	21	8.3	47
Koeleria cristata	.1		.7	4
Poa sp.	.2	1	.6	3
Stipa columbiana	.3	2	1.8	10
S. comata	T		.2	1
TOTAL GRASSES AND SEDGES	6.3	34	13.8	79
Achillea millefolium	.4	2	.2	1
Agoseris glauca	.3	2	T	
Antennaria rosea	.5	3	.1	1
Arabis holboellii	T			
Arenaria congesta	.1		.1	1
Arnica fulgens	T		T	
Astragalus miser	.4	2	.2	1
Astragalus sp.			T	
Besseyia wyomingensis	T			
Campanula rotundifolia			T	
Cerastium nutans			T	
Cirsium vulgare	T			
Clematis hirsutissima	.2	1	.1	1
Collomia linearis	.1		T	
Dodecatheon conjugens	T		T	
Erigeron caespitosus	.2	1	.1	1
Galium boreale	.1		T	
Geranium viscosissimum	1.4	8	1.1	6
Geum triflorum	.6	3	T	
Helianthus annuus	T			
Lupinus spp.	1.0	5	.9	5
Mertensia alpina	T			
M. longifolia	T			
M. oblongifolia	T			
Myosotis alpestris	.3	2		
Penstemon aridus	.3	2	T	
Phlox hoodii	.2	1	T	
P. kelseyi	T			
P. longifolia	T		T	
Potentilla arguta	.2	1		
P. gracilis	T			
Rumex paucifolius	.1		T	
Senecio integerrimus	T			

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Species	UNSPRAYED		SPRAYED	
	Ave. sq dm	Percent of	Ave. sq dm	Percent of
	per 20 sq dm	total veg.	per 20 sq dm	total veg.
	plot	cover	plot	cover
		%		%
Taraxacum laevigatum	1.2	7	.6	3
Thalictrum occidentale	T			
Viola nuttallii	.1	1	T	
Zygadenus venenosus	T			
(Total forb traces)	(.3)	(2)	(.2)	(1)
TOTAL FORBS	8.0	44	3.6	21
Artemisia tridentata	3.7	20	T	
A. tripartita	.1			
Chrysothamnus nauseosus	T		T	
Rosa woodsii			.1	1
Symphoricarpos albus	.1			
Tetradymia canescens	.1		T	
TOTAL SHRUBS	4.0	22	.1	1
Bare ground	T		.2	

CORRAL CREEK MAP

See Beaver-Shovel map

CORRAL CREEK

Location: S12 T12S R4W

Soil: Clay loam. Very
stony below 18
inches. pH 6.5

Sprayed: 1967

Sampled: August 14, 1970



General view

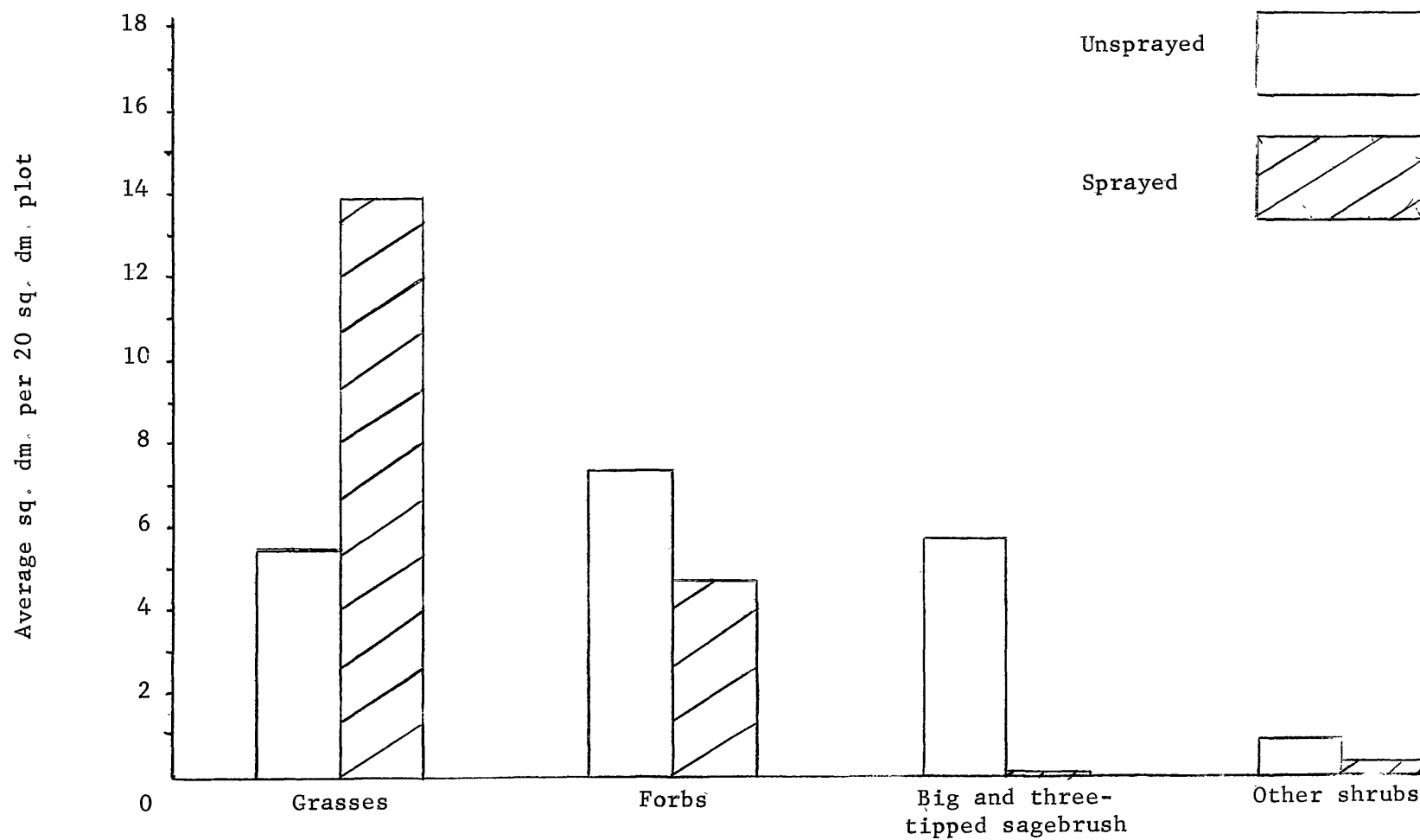


Unsprayed



Sprayed

Cover data for vegetation groupings on unsprayed and sprayed vegetation at Corral Creek. Sprayed 1967. Sampled August 14, 1970.



Cover data for Corral Creek, comparing unsprayed and sprayed (1967)
vegetation. Sampled August 14, 1970.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm	Percent of	Ave. sq dm	Percent of
	per 20 sq dm	total veg.	per 20 sq dm	total veg.
	plot	cover	plot	cover
		%		%
Agropyron dasystachyum	1.4	7	5.5	29
Bromus marginatus	.2	1	.1	
Carex spp.	.5	3		
Festuca idahoensis	2.3	12	7.6	40
Koeleria cristata			T	
Poa sp.	.5	3	.6	3
Stipa comata	.4	2	.2	1
TOTAL GRASSES AND SEDGES	5.4	28	13.9	73
Achillea millefolium	.2	1	.3	2
Androsace septentrionalis			T	
Antennaria rosea	.6	3	.1	
Arabis holboellii	.1			
Arenaria congesta	.2	1	.8	4
Arnica fulgens			T	
Astragalus sp.			T	
Aster sp.			T	
Besseyia cineria	T			
Clematis hirsutissima	.1			
Collomia linearis	.2	1	.9	5
Dodecatheon conjugens	T			
Eriogonum sp.	1.1	6	.7	4
Geranium viscosissimum	T			
Geum triflorum	.8	4	.1	
Lomatium triternatum	T			
Lupinus spp.	1.4	7	.6	3
Penstemon aridus	T		T	
Phlox hoodii	.2	1	.5	3
P. longifolia			T	
Phlox sp.	.2	1		
Polygonum convolvulus			T	
Polygonum sp.	.6	3	.1	
Potentilla gracilis	1.2	6	.1	
Senecio lugens			.1	
Taraxacum laevigatum	.2	1	.2	1
Tragopogon dubius	T			
Umbelliferae sp.	.1		T	
(Total forb traces)	(.1)		(.3)	(2)
TOTAL FORBS	7.3	38	4.8	25

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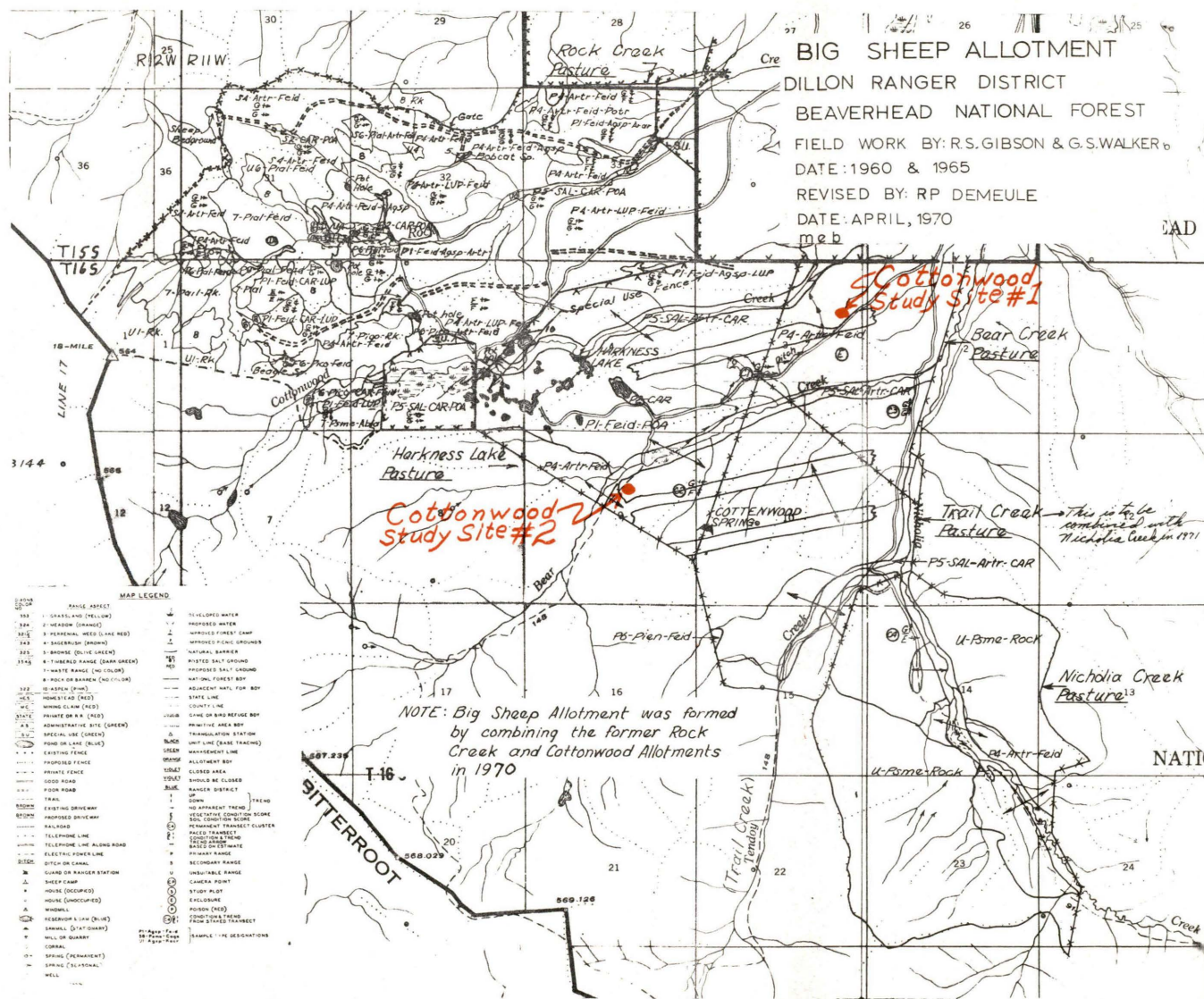
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Species	UNSPRAYED		SPRAYED	
	Ave. sq dm	Percent of	Ave. sq dm	Percent of
	per 20 sq dm	total veg.	per 20 sq dm	total veg.
	plot	cover	plot	cover
		%		%
Artemisia tridentata				
ssp. vaseyana	5.7	30	.1	
Chrysothamnus viscidiflorus	.8	4	.3	2
Tetradymia canescens			T	
TOTAL SHRUBS	6.4	34	.4	2
Bare ground	.1			

Average production in grams per 20 sq dm plot and in percent on
Corral Creek, showing unsprayed and sprayed comparisons.
Sampled August 14, 1970.

Species	UNSPRAYED		SPRAYED	
	Grams	Percent	Grams	Percent
Agropyron dasystachyum	6.97	23	13.80	38
Bromus marginatus	1.80	6		
Carex spp.	3.42	11		
Festuca idahoensis	2.44	8	11.66	32
Poa sp.	.40	1	.38	1
Stipa columbiana			.43	1
S. richardsonii			2.26	6
Misc. perennial grasses and sedges	<u>3.58</u>	<u>12</u>	<u>1.78</u>	<u>5</u>
TOTAL GRASSES AND SEDGES	18.61	62	30.31	83
Achillea millefolium			.50	1
Arenaria congesta			.67	2
Arnica fulgens			.67	2
Geum trifolium	1.10	4		
Lupinus spp.	3.46	12	2.25	6
Polygonum sp.	1.49	5		
Potentilla gracilis	1.82	6		
Taraxacum laevigatum	.23	1		
Miscellaneous forbs	<u>3.27</u>	<u>11</u>	<u>2.19</u>	<u>6</u>
TOTAL FORBS	11.37	38	6.28	17
TOTAL PRODUCTION	29.98		36.59	

note: grams/plot X 44.6 = lbs/acre



COTTONWOOD

SITE NO. 1

Location: S3 T16S R11W

Soil: Stony clay loam

Sprayed: 1961

Sampled: July 28-30, 1972

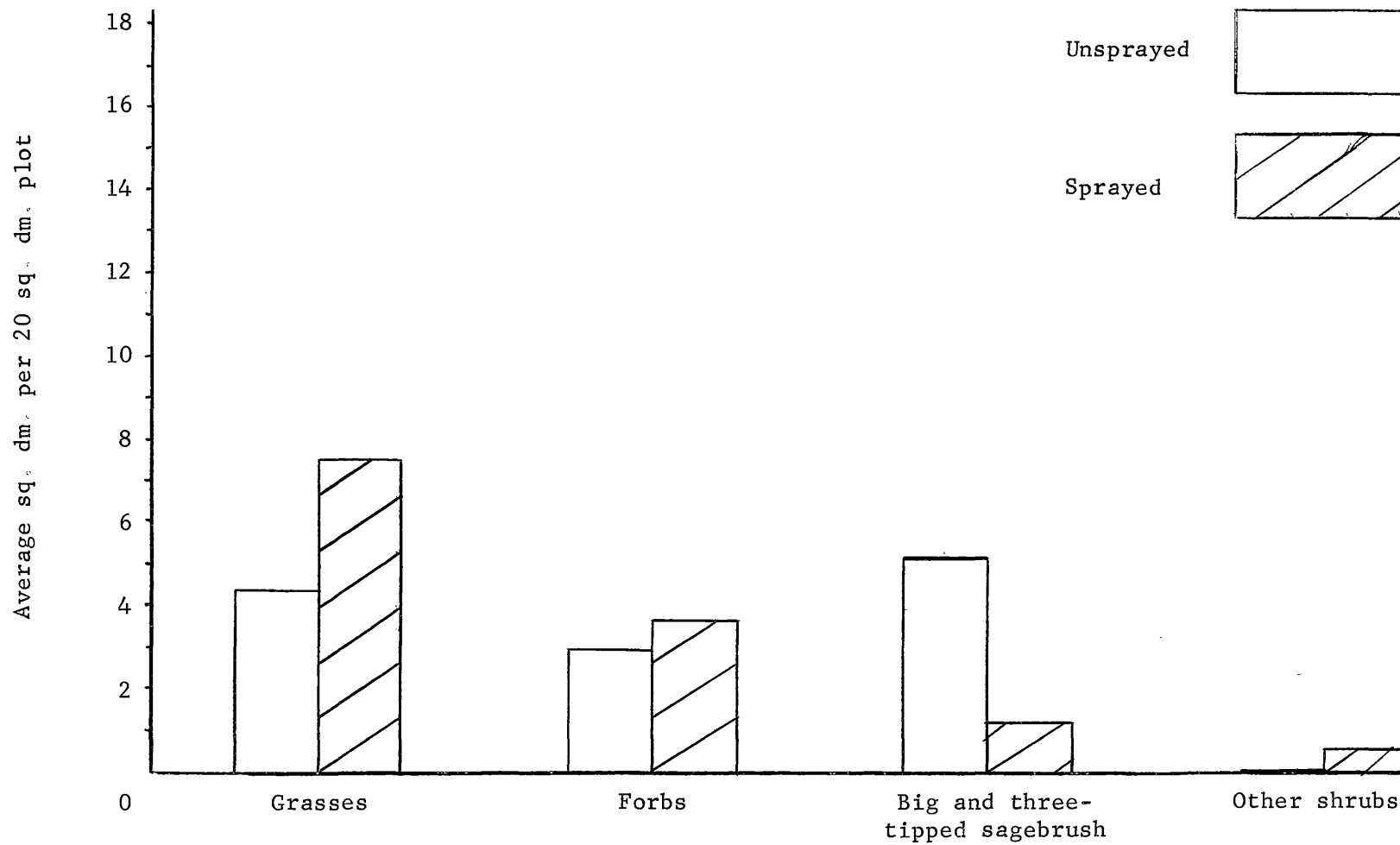


Unsprayed



Sprayed

Cover data for vegetation groupings on unsprayed and sprayed vegetation at Cottonwood, Site 1. Sprayed 1961. Sampled July 28-30, 1972.



Cover data for Cottonwood, Site 1, comparing unsprayed and sprayed
(1961) vegetation. Sampled July 28-30, 1972.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Agropyron smithii			T	
A. spicatum	.6	5	1.2	9
Carex spp.	T		T	
Festuca idahoensis	3.4	27	5.8	45
Koeleria cristata	.1	1	.2	1
Poa sp.	.2	2	.3	2
TOTAL GRASSES AND SEDGES	4.4	35	7.5	58
Achillea millefolium	.3	2	T	
Agoseris glauca	T			
Antennaria rosea	1.3	10	1.6	12
Arabis holboellii	T		T	
Arenaria congesta	T			
Arnica fulgens	T			
Astragalus miser	T		.8	6
Astragalus sp.			T	
Besseyia wyomingensis	T		T	
Castilleja flava	.1	1	T	
Cerastium nutans	T		T	
Erigeron alpinus	T			
E. pumilus	T		T	
Lupinus spp.	.6	5	.4	3
Microseris nutans	T			
Phlox hoodii			.2	1
P. kelseyi			T	
P. longifolia	.1	1	.4	3
Sedum stenopetalum	T			
Senecio integerrimus			T	
Taraxacum laevigatum	.2	2	.1	1
(Total forb traces)	(.3)	(2)	(.2)	(1)
TOTAL FORBS	2.9	23	3.7	28
Artemisia frigida			T	
A. tridentata			1.2	9
A. tripartita	5.2	42		
Chrysothamnus nauseosus	T		.1	1
Tetradymia canescens			.5	4
TOTAL SHRUBS	5.2	42	1.8	14
Bare ground	1.2		.7	

COTTONWOOD

SITE NO. 2

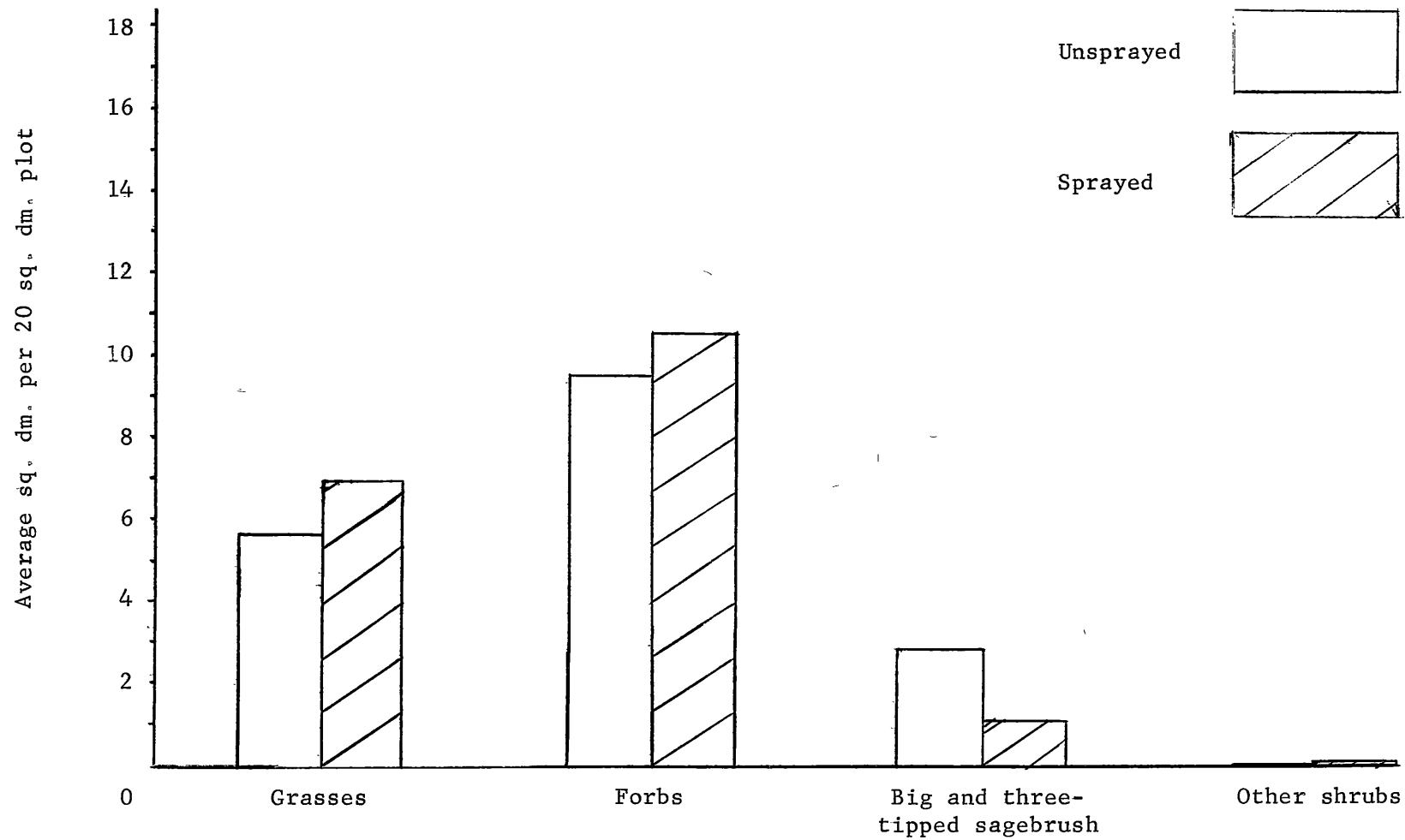
Location: S9 T16S R11W

Soil: Clay to clay loam (pH 6.0)
overlying shale at 12-20 inches.

Sprayed: 1961

Sampled: August 1-2, 1972

Cover data for vegetation groupings on unsprayed and sprayed vegetation at Cottonwood, Site 2. Sprayed 1961. Sampled August 1-2, 1972.



Cover data for Cottonwood, Site 2, comparing unsprayed and sprayed
(1961) vegetation. Sampled August 1-2, 1972.

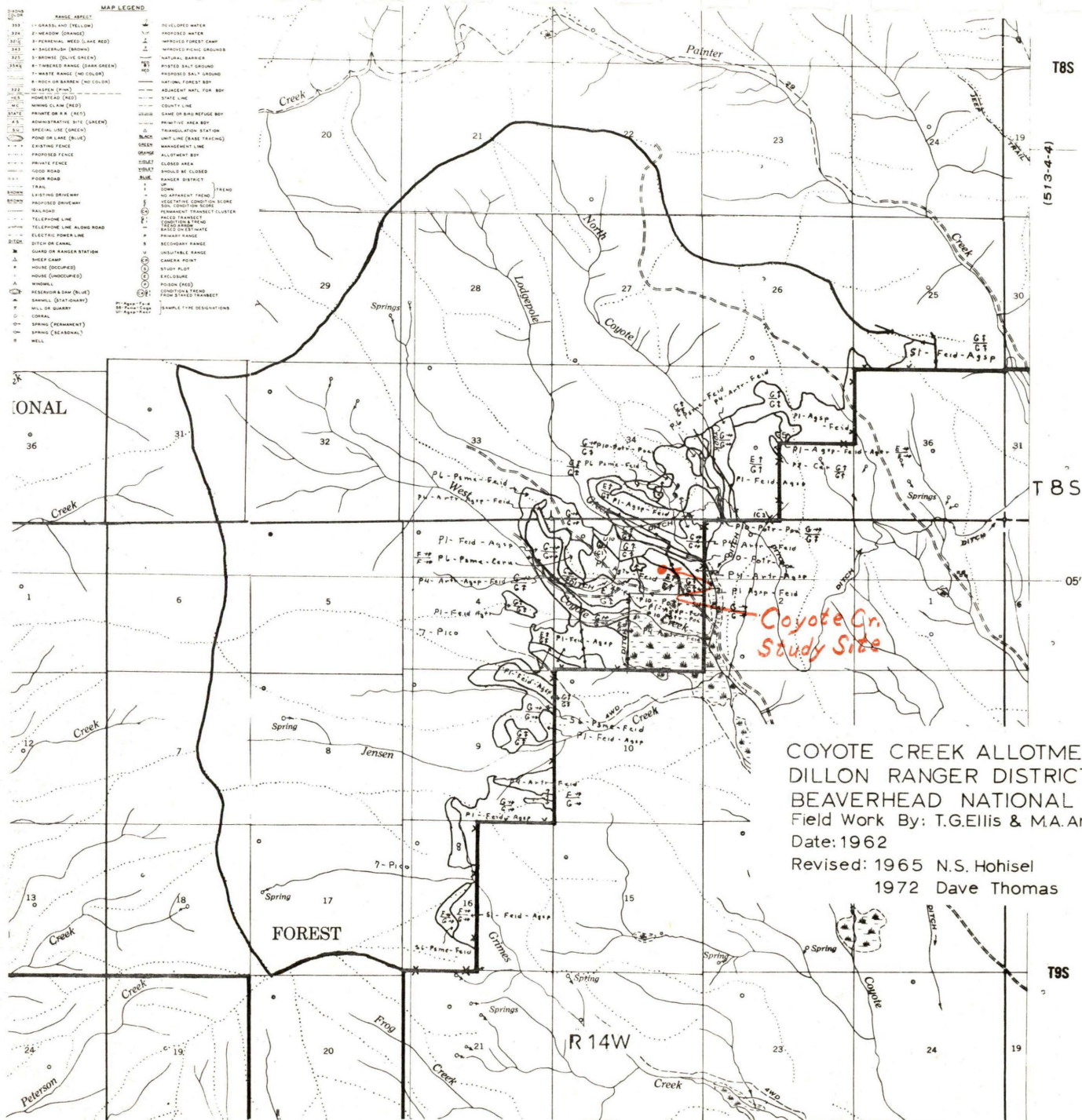
Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Agropyron smithii	.1		.1	
A. spicatum	1.0	5	1.7	9
Bromus marginatus			.2	1
Carex spp.	.5	3	.4	2
Danthonia intermedia	.1		T	
Festuca idahoensis	3.5	19	3.3	18
Koeleria cristata	.2	1	.2	1
Melica bulbosa	T			
Poa sp.	.2	1	.1	
Stipa columbiana	.1		.9	5
TOTAL GRASSES AND SEDGES	5.7	31	6.9	37
Achillea millefolium	.2	1	.5	3
Agoseris glauca	T		T	
Allium textile	T		.1	
Anaphalis margaritacea	.3	2	.4	2
Antennaria rosea	1.0	5	1.1	6
Arabis nuttallii	T		T	
Arenaria congesta	.5	3	.6	3
Arnica fulgens			T	
Astragalus miser	.7	4	.1	
Astragalus sp.	.1		T	
Besseyia wyomingensis	.3	2	.3	2
Castilleja flava	.2	1	.3	2
Crepis acuminata			T	
Dodecatheon conjugens	T		T	
Erigeron caespitosus	.6	3	.5	3
Erigeron sp.	.1		.1	
Frasera speciosa	T		T	
Galium boreale			.1	
Geum triflorum	2.7	15	2.0	11
Heuchera parviflora	.2	1	.2	1
Lomatium nudicaule			.2	1
Lomatium sp.	.1			
Lupinus spp.	.2	1	1.1	6
Mertensia longifolia	T		T	
Myosotis alpestris			T	
Pedicularis sp.	T			
Penstemon aridus	.1		.1	
Phlox kelseyi	1.7	9	2.2	12
Potentilla gracilis	T		T	
Rumex paucifolius	T		T	
Senecio lugens			T	

Continued on next page.

(Continued).

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover
		%		%
Taraxacum laevigatum	.3	2	.4	2
Unidentified species	T			
(Total forb traces)	(.3)	(2)	(.3)	(2)
TOTAL FORBS	9.6	53	10.6	57
Artemisia tridentata	2.8	15	1.1	6
Rosa woodsii	T		.1	
TOTAL SHRUBS	2.8	15	1.2	6
Bare ground	.1		.1	

MAP LEGEND	
1- GRASSLAND (YELLOW)	DEVELOPED WATER
2- MEADOW (ORANGE)	PROPOSED WATER
3- FORESTLAND (RED)	IMPROVED FOREST CAMP
4- BAKERLAND (BROWN)	WATERED FENCE GROUND
5- BRUSH (OLIVE GREEN)	NATURAL BARREN
6- THICKER RANGE (DARK GREEN)	PISTED BALT GROUND
7- WASTE RANGE (NO COLOR)	PROPOSED BALT GROUND
8- ROAD OR BARREN (NO COLOR)	NATURAL FOREST BAY
9- BARREN (NO COLOR)	ADJACENT NATL FOR BAY
10- BARREN (NO COLOR)	STATE LINE
11- BARREN (NO COLOR)	COUNTY LINE
12- BARREN (NO COLOR)	STATE OR BAY REFUGE BAY
13- BARREN (NO COLOR)	PRIMITIVE AREA BAY
14- BARREN (NO COLOR)	TRANSLATION STATION
15- BARREN (NO COLOR)	UNIT LINE (BASE TRACING)
16- BARREN (NO COLOR)	MANAGEMENT LINE
17- BARREN (NO COLOR)	ALLIANCE BAY
18- BARREN (NO COLOR)	CLOSED AREA
19- BARREN (NO COLOR)	SHOULD BE CLOSED
20- BARREN (NO COLOR)	RANGER DISTRICT
21- BARREN (NO COLOR)	UP
22- BARREN (NO COLOR)	DOWN
23- BARREN (NO COLOR)	NO APPARENT TREND
24- BARREN (NO COLOR)	ROAD TRAIL
25- BARREN (NO COLOR)	ROAD TRAIL
26- BARREN (NO COLOR)	ROAD TRAIL
27- BARREN (NO COLOR)	ROAD TRAIL
28- BARREN (NO COLOR)	ROAD TRAIL
29- BARREN (NO COLOR)	ROAD TRAIL
30- BARREN (NO COLOR)	ROAD TRAIL
31- BARREN (NO COLOR)	ROAD TRAIL
32- BARREN (NO COLOR)	ROAD TRAIL
33- BARREN (NO COLOR)	ROAD TRAIL
34- BARREN (NO COLOR)	ROAD TRAIL
35- BARREN (NO COLOR)	ROAD TRAIL
36- BARREN (NO COLOR)	ROAD TRAIL
37- BARREN (NO COLOR)	ROAD TRAIL
38- BARREN (NO COLOR)	ROAD TRAIL
39- BARREN (NO COLOR)	ROAD TRAIL
40- BARREN (NO COLOR)	ROAD TRAIL
41- BARREN (NO COLOR)	ROAD TRAIL
42- BARREN (NO COLOR)	ROAD TRAIL
43- BARREN (NO COLOR)	ROAD TRAIL
44- BARREN (NO COLOR)	ROAD TRAIL
45- BARREN (NO COLOR)	ROAD TRAIL
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55- BARREN (NO COLOR)	ROAD TRAIL
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59- BARREN (NO COLOR)	ROAD TRAIL
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83- BARREN (NO COLOR)	ROAD TRAIL
84- BARREN (NO COLOR)	ROAD TRAIL
85- BARREN (NO COLOR)	ROAD TRAIL
86- BARREN (NO COLOR)	ROAD TRAIL
87- BARREN (NO COLOR)	ROAD TRAIL
88- BARREN (NO COLOR)	ROAD TRAIL
89- BARREN (NO COLOR)	ROAD TRAIL
90- BARREN (NO COLOR)	ROAD TRAIL
91- BARREN (NO COLOR)	ROAD TRAIL
92- BARREN (NO COLOR)	ROAD TRAIL
93- BARREN (NO COLOR)	ROAD TRAIL
94- BARREN (NO COLOR)	ROAD TRAIL
95- BARREN (NO COLOR)	ROAD TRAIL
96- BARREN (NO COLOR)	ROAD TRAIL
97- BARREN (NO COLOR)	ROAD TRAIL
98- BARREN (NO COLOR)	ROAD TRAIL
99- BARREN (NO COLOR)	ROAD TRAIL
100- BARREN (NO COLOR)	ROAD TRAIL



4-4-515/W
504-504

COYOTE CREEK

Location: S3 T9S R14W

Soil: Sandy clay, very stony
below 4 inches.

Sprayed: 1970

Sampled: July 7-12, 1971

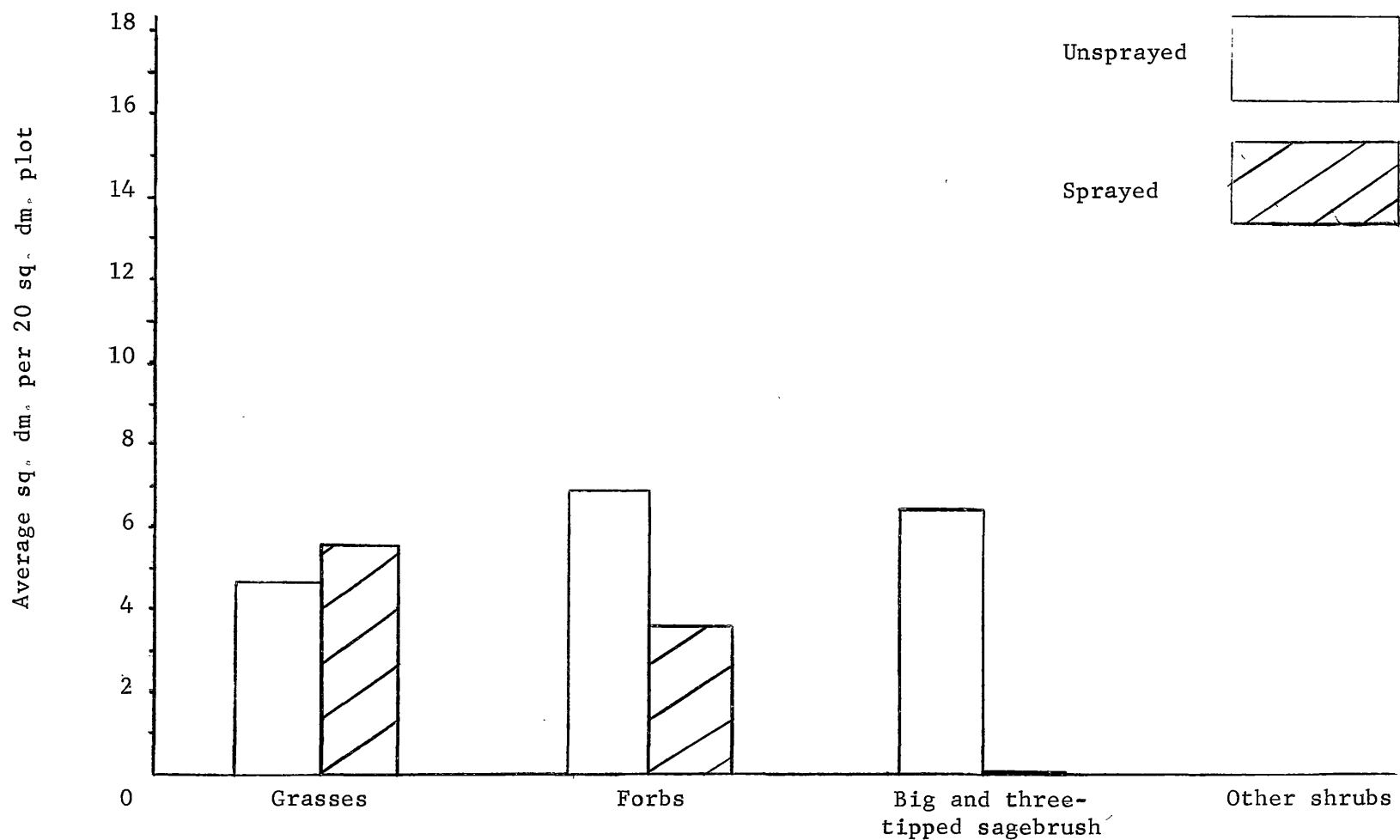


Unsprayed



Sprayed

Cover data for vegetation groupings on unsprayed and sprayed vegetation at Coyote Creek. Sprayed 1970. Sampled July 7-12, 1971.



Cover data for Coyote Creek, comparing unsprayed and sprayed (1970)
vegetation. Sampled July 7-12, 1971.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover
		%		%
Agropyron spicatum	.7	4	.9	10
Carex spp.	.2	1	.4	4
Danthonia unispicata	T		T	
Festuca idahoensis	3.0	17	3.3	36
Koeleria cristata			.1	1
Poa sp.	.6	3	.9	10
TOTAL GRASSES AND SEDGES	4.6	26	5.6	61
Achillea millefolium	.3	2	.2	2
Agoseris glauca	T			
Antennaria rosea	.1		T	
Arabis holboellii	T		T	
Arenaria congesta	.8	4	1.4	15
Arnica fulgens	.7	4	.1	1
Balsamorhiza sagittata	.2	1		
Calochortus nitidus	.1		.2	2
Camassia quamash	T			
Castilleja sp.	T			
Collinsia parvifolia	.1		.2	2
Collomia linearis	.4	2	.1	1
Delphinium bicolor	.1		.2	2
Dodecatheon conjugens	T		T	
Draba nemorosa	T		T	
Eriogonum caespitosum	.7	4	.4	4
Fritillaria atropurpurea	T			
Geranium viscosissimum	.2	1		
Hieracium scouleri	.1		.1	1
Lithophragma parviflora			T	
Lomatium triternatum	.1		T	
Lupinus spp.	1.5	8	.1	1
Mertensia oblongifolia	.1			
Microseris nutans	.1			
Phlox longifolia	.2	1	.2	2
Polygonum aviculare			T	
Sedum stenopetalum	.2	1	.1	1
Senecio lugens	.5	3	.2	2
Taraxacum laevigatum	.1		.1	1
Viola nuttallii	.1		T	
Zygadenus venenosus	.1		T	
(Total forb traces)	(.1)			
TOTAL FORBS	6.9	38	3.6	39

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(Continued).

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Artemisia tridentata	6.4	36	T	
TOTAL SHRUBS	6.4	36	T	
Bare ground	.1		.6	

Average production in grams per 20 sq dm plot and in percent on
Coyote Creek, showing unsprayed and sprayed comparisons.
Sampled July 7-12, 1971.

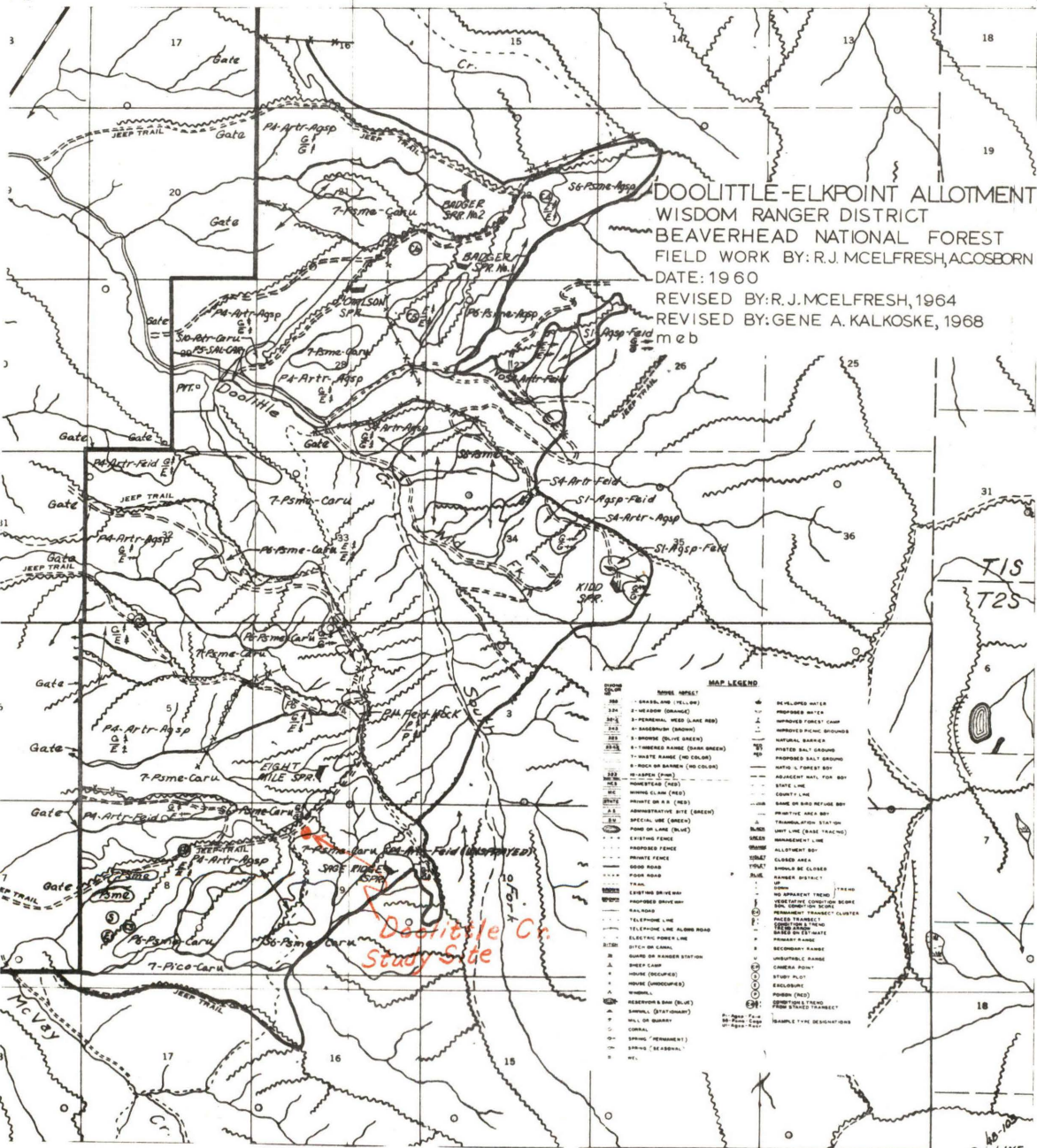
Species	UNSPRAYED		SPRAYED	
	Grams	Percent	Grams	Percent
Agropyron spicatum	3.00	11	3.27	14
Carex spp.	1.18	5	.03	
Danthonia unispicata	.06		.25	1
Festuca idahoensis	9.95	37	10.30	45
Poa sp.	1.95	7	3.00	13
TOTAL GRASSES AND SEDGES	16.14	60	16.85	73
Achillea millefolium	.64	2	.23	1
Arenaria congesta	2.41	9	4.85	21
Arnica fulgens	.51	2	.04	
Calochortus nitidus	.16	1	.48	2
Collomia linearis	.73	3		
Lupinus spp.	2.67	10	.01	
Phlox longifolia	1.40	5	.23	1
Senecio lugens	.86	3		
Miscellaneous forbs	1.24	5	.51	2
TOTAL FORBS	10.62	40	6.35	27
TOTAL PRODUCTION	26.76		23.20	

note: grams/plot X 44.6 = lbs/acre

R14W

1-2

110



DOOLITTLE CREEK

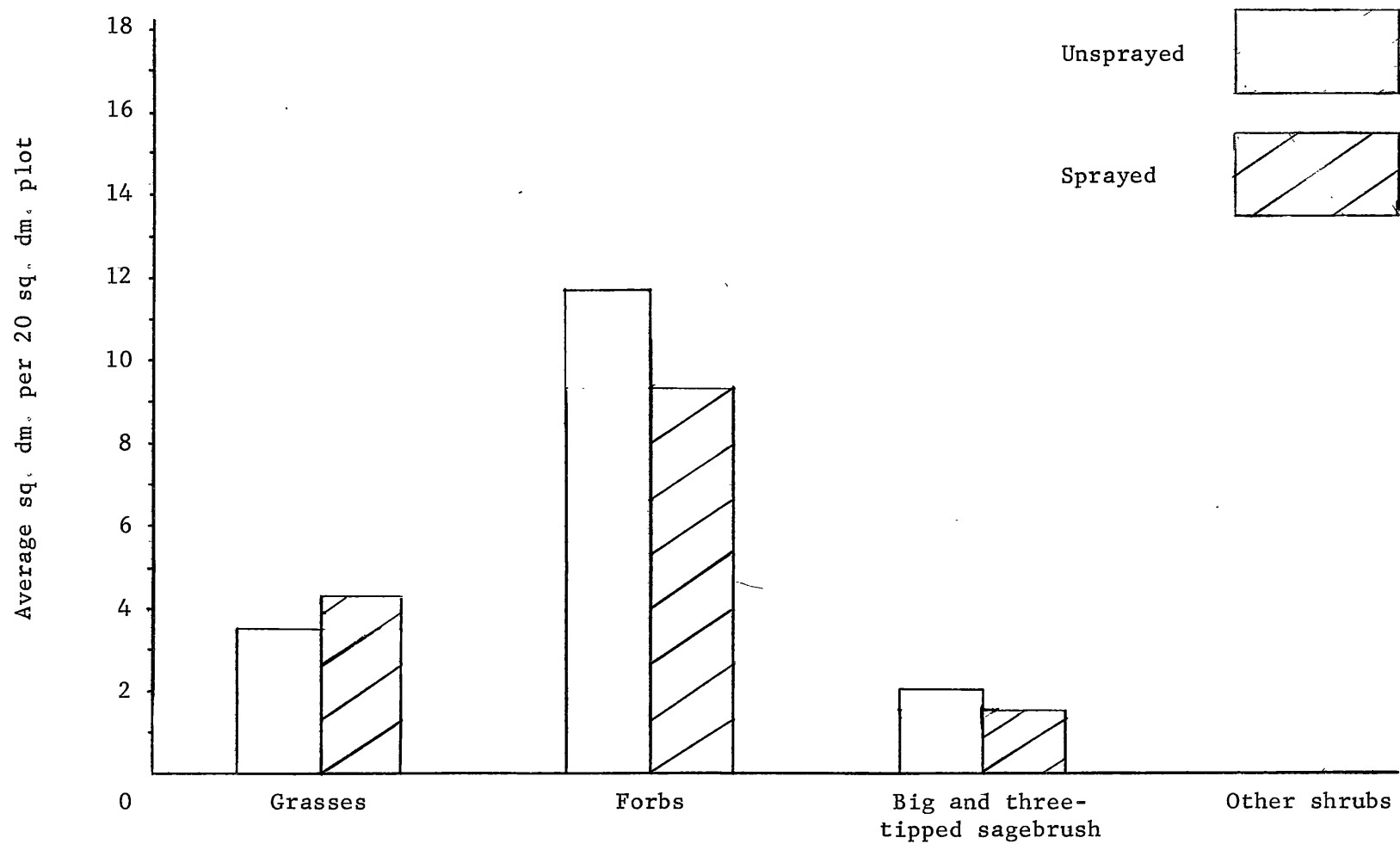
Location: S9 T2S R14W

Soil: Fine sandy loam (pH 6.25)
overlying coarse sandy loam
on granite bedrock at 24 inches.

Sprayed: 1959

Sampled: June 19-21, 1972

Cover data for vegetation groupings on unsprayed and sprayed vegetation at Doolittle Creek. Sprayed 1959. Sampled June 19-21, 1972.



Cover data for Dolittle Creek, comparing unsprayed and sprayed (1959) vegetation. Sampled June 19-21, 1972.

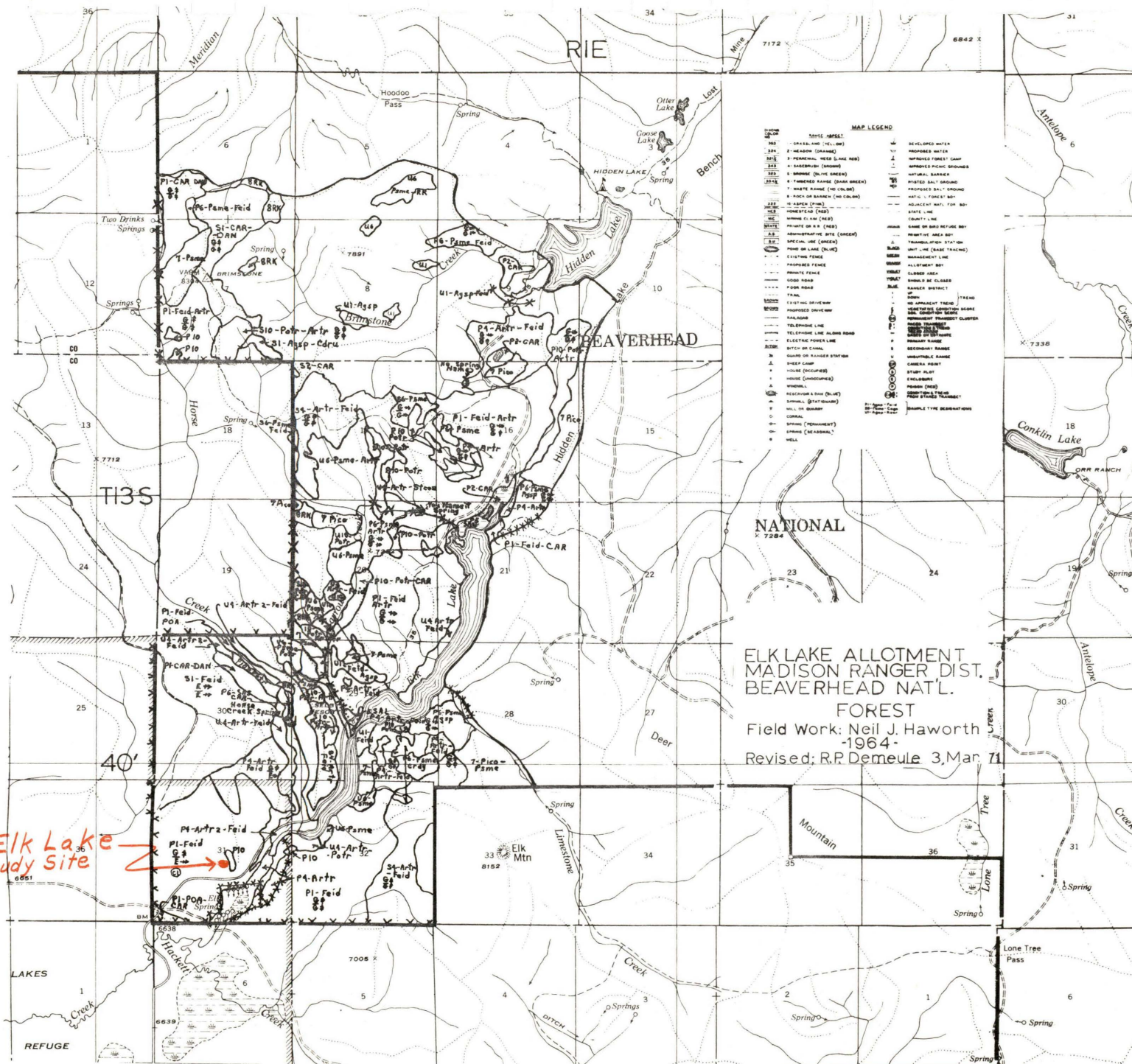
Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover
		%		%
Agropyron spicatum	1.2	7	2.1	14
Carex spp.	.1	1	.2	1
Danthonia unispicata	.1	1	T	
Festuca idahoensis	1.7	10	1.1	7
Koeleria cristata	.2	1	.4	3
Poa sp.	.2	1	.4	3
Stipa comata			.1	1
TOTAL GRASSES AND SEDGES	3.5	20	4.3	28
Achillea millefolium	.3	2	.3	2
Agoseris glauca	.8	5	.3	2
Anaphalis margaritacea	.2	1	.4	3
Antennaria rosea	.2	1	.4	3
Arabis holboellii	.2	1	.2	1
A. nuttallii	T		T	
Arenaria congesta	.6	3	.5	3
Arnica fulgens	.2	1	.2	1
Castilleja flava	T		T	
Claytonia lanceolata	.2	1	.1	1
Collinsia parviflora	.1	1	.2	1
Collomia linearis	.1	1	.1	1
Delphinium bicolor	.3	2	.3	2
Dodecatheon conjugens	.4	2	.4	3
Draba nemorosa			T	
Erigeron alpinus	2.1	12	1.9	12
Fragaria virginiana	1.2	7	T	
Fritillaria atropurpurea	.1	1	.1	1
Geranium viscosissimum	.5	3	.4	3
Geum triflorum	T		.1	1
Hieracium scouleri	.6	3	.4	3
Lomatium triternatum	.1	1	.2	1
Lupinus spp.	1.4	8	.5	3
Mertensia longifolia	.2	1	T	
M. oblongifolia			.1	1
Microseris nutans	.1	1	.2	1
Phlox longifolia	.3	2	.2	1
Rumex paucifolius	T		.2	1
Senecio canus	.3	2	.4	3
S. integerrimus	T			
Taraxacum laevigatum	.5	3	.6	4
Viola nuttallii	.2	1	.2	1
Unidentified species no. 1	.2	1	.2	1
Unidentified species no. 2	.1	1	.1	1

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(Continued)

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
(Total forb traces)	<u>(.2)</u>	<u>(1)</u>	<u>(.1)</u>	<u>(1)</u>
TOTAL FORBS	11.7	68	9.3	61
Artemisia tridentata	<u>2.0</u>	<u>12</u>	<u>1.6</u>	<u>10</u>
TOTAL SHRUBS	2.0	12	1.6	10
Bare ground	.4		.7	

Elk Lake
Study Site



ELK LAKE ALLOTMENT
MADISON RANGER DIST.
BEAVERHEAD NAT'L.

FOREST

Field Work: Neil J. Haworth
-1964-

Revised: R.P. Demeule 3, Mar. 71

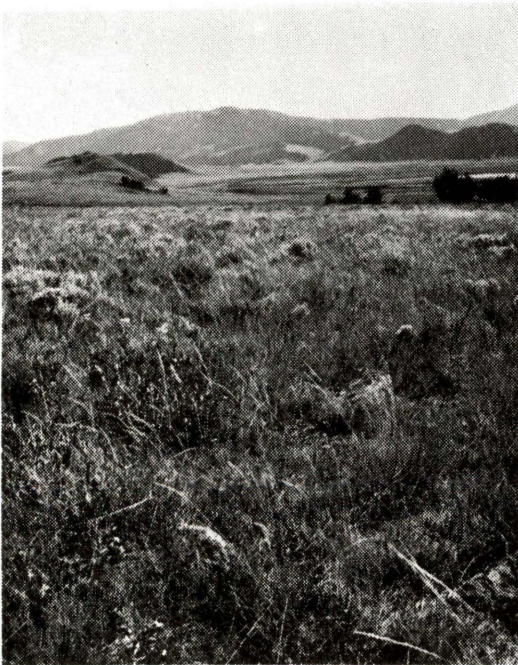
ELK LAKE

Location: S31 T13S R1E

Soil: Silty clay with large
boulders

Sprayed: 1966

Sampled: July 15-16, 1971

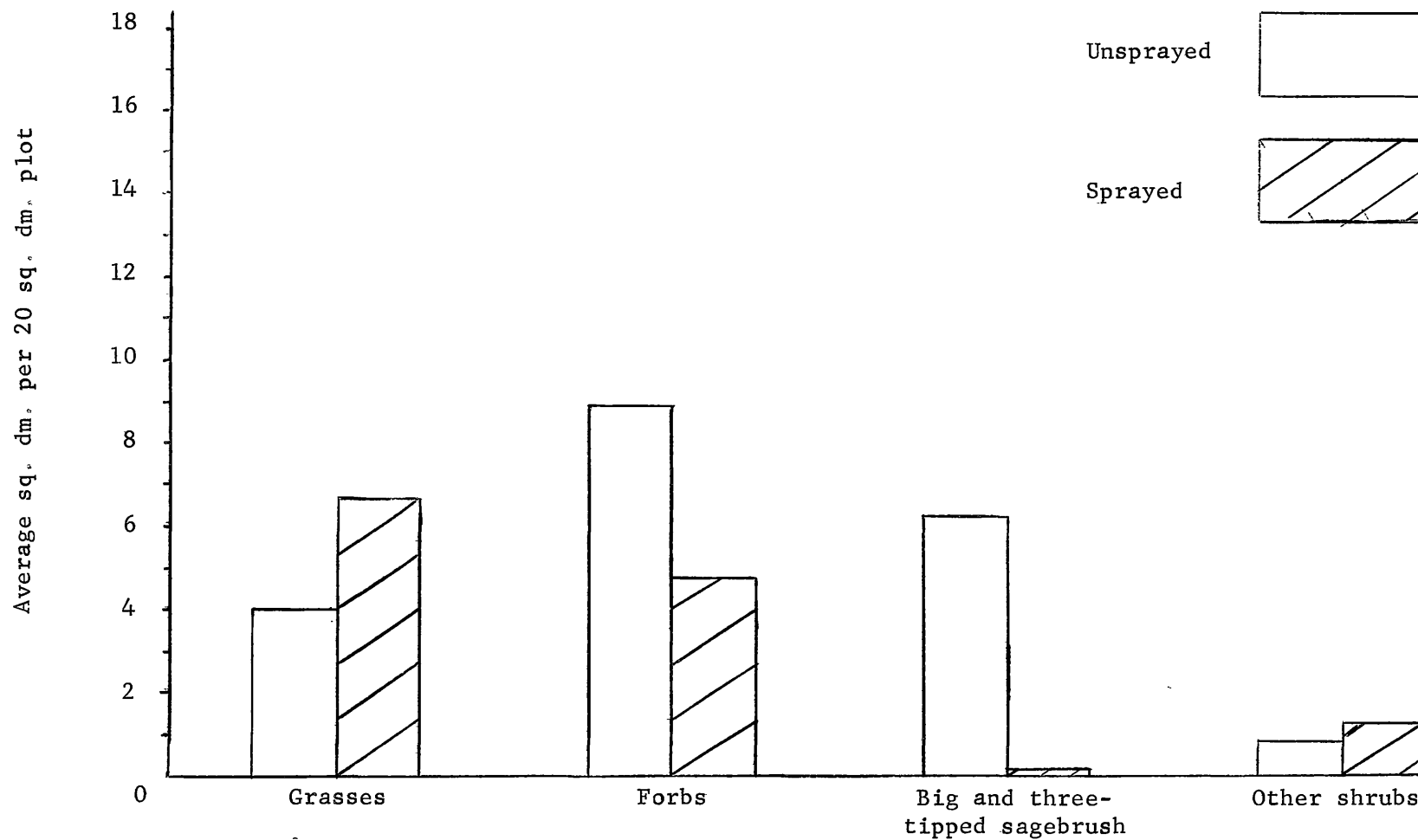


General view



Sprayed

Cover data for vegetation groupings on unsprayed and sprayed vegetation at Elk Lake. Sprayed 1966. Sampled July 15-16, 1971.



Cover data for Elk Lake, comparing unsprayed and sprayed (1966)
vegetation. Sampled July 15-16, 1971.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Agropyron dasystachyum	.4	2	.2	1
A. spicatum	.3	1	1.5	12
Carex spp.	.3	1	.2	1
Elymus cinereus			T	
Festuca idahoensis	2.1	10	2.4	19
Koeleria cristata	.4	2	.4	3
Poa sp.	.5	2	1.1	8
Stipa comata	T		.9	7
TOTAL GRASSES AND SEDGES	4.0	20	6.7	52
Achillea millefolium	.3	1	.2	1
Agoseris glauca	T		T	
Antennaria rosea	.9	4	.1	1
Arabis holboellii	T		T	
Arnica fulgens	T			
Astragalus miser	.6	3	.9	7
Castilleja sp.	T			
Collinsia parviflora	T		T	
Collomia linearis			T	
Comandra umbellata	.3	1	.2	1
Crepis acuminata	T		T	
Dodecatheon conjugens	T			
Eriogonum caespitosum	1.8	9	1.4	11
Erysimum inconspicuum	T		T	
Geranium viscosissimum	T			
Helianthella uniflora	.9	4		
Lithospermum pilosum	.1			
Lomatium triternatum	T		T	
Lupinus spp.	3.1	15	1.4	11
Mertensia longifolia	.1			
Penstemon eriantherus	.2	1	.1	1
Phlox hoodii	.1		.3	2
P. longifolia	T			
Senecio lugens	T		T	
Taraxacum laevigatum	.2	1	.1	1
Tragopogon dubius	T		T	
Viola nuttallii	T			
(Total forb traces)	(.3)	(1)		
TOTAL FORBS	8.9	44	4.7	36
Artemisia tripartita	6.3	31	.2	1
Chrysothamnus viscidiflorus	T		.1	1

Continued on next page.

(Continued).

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Symphorocarpus albus	.3	1	.9	7
Tetradymia canescens	<u>.5</u>	<u>2</u>	<u>.2</u>	<u>1</u>
TOTAL SHRUBS	7.1	35	1.5	12
Bare ground	.3		1.0	

Average production in grams per 20 sq dm plot and in percent on
Elk Lake, showing unsprayed and sprayed comparisons.
Sampled July 15-16, 1971.

Species	UNSPRAYED		SPRAYED	
	Grams	Percent	Grams	Percent
Agropyron dasystachyum	2.34	11	.75	3
A. spicatum	.86	4	4.02	18
Carex spp.	1.57	8	.63	3
Festuca idahoensis	3.91	19	5.82	26
Koeleria cristata	.75	4	.89	4
Poa sp.	1.78	9	2.83	13
Stipa comata			2.82	13
TOTAL GRASSES AND SEDGES	11.21	55	17.76	80
Achillea millefolium	1.24	6	1.62	7
Comandra umbellata	1.79	9	.11	
Helianthella uniflora	.63	3		
Lupinus spp.	4.22	21	2.52	11
Penstemon eriantherus	.68	3	.01	
Miscellaneous forbs	.63	3	.31	2
TOTAL FORBS	9.19	45	4.57	20
TOTAL PRODUCTION	20.40		22.33	

note: grams/plot X 44.6 = lbs/acre

HEADQUARTERS MAP

See Beaver-Shovel map

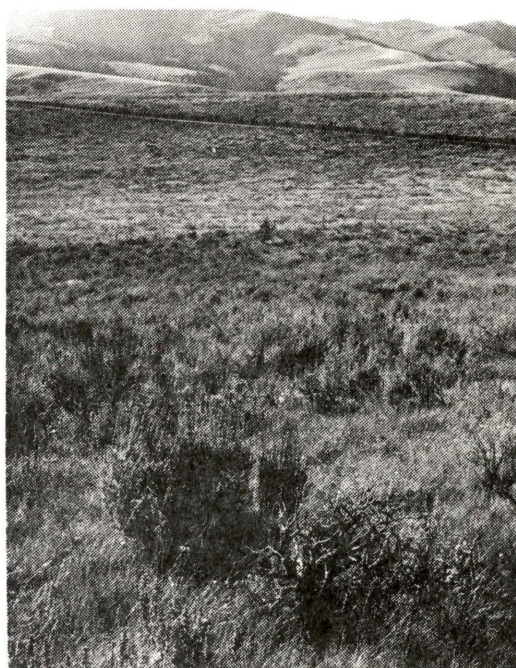
HEADQUARTERS

Location: S8 T12S R3W

Soil: Clay loam over sandy clay
loam. pH 6.5

Sprayed: 1967

Sampled: August 4-7, 1972



General view

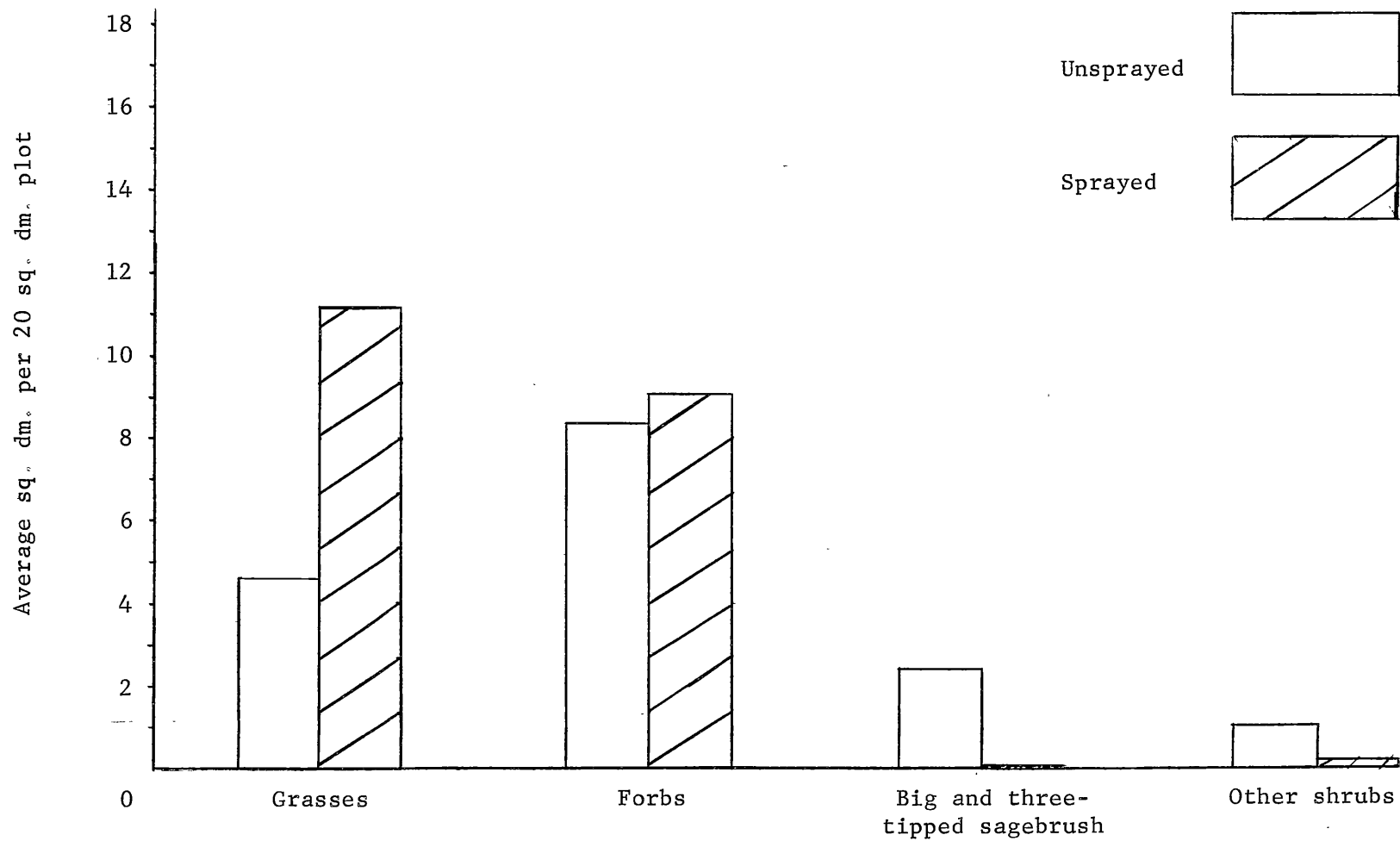


Unsprayed



Sprayed

Cover data for vegetation groupings on unsprayed and sprayed vegetation at Headquarters. Sprayed 1967. Sampled August 4-7, 1972.



Cover data for Headquarters, comparing unsprayed and sprayed (1967)
vegetation. Sampled August 4-7, 1972.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Agropyron dasystachyum	.7	4	.9	4
A. riparium	.3	2	.8	4
A. smithii			T	
Bromus marginatus	1.2	7	5.6	27
B. pumpellianus	.1	1	T	
Carex spp.	.2	1	.3	1
Festuca idahoensis	1.7	10	2.7	13
Koeleria cristata	.1	1	.1	
Melica bulbosa	T			
Poa sp.	.3	2	.6	3
Stipa columbiana	T		.1	
TOTAL GRASSES AND SEDGES	4.6	28	11.2	55
Achillea millefolium	.7	4	1.1	5
Agoseris glauca	.3	2	T	
Anaphalis margaritacea			T	
Antennaria rosea	.1	1		
Arabis holboellii	T			
Arenaria congesta	.1	1	T	
Astragalus miser	T			
Astragalus sp.			.1	
Campanula rotundifolia			.1	
Cerastium nutans			T	
Clematis hirsutissima	.2	1	.1	
Collinsia parviflora			T	
Collomia linearis	1.5	9	1.8	9
Dodecatheon conjugens	T		T	
Draba nemorosa	T		T	
Erigeron alpinus	.2	1	.2	1
Erysimum sp.	T		.1	
Fragaria virginiana	.7	4	.2	1
Galium boreale	T		.4	2
Geranium viscosissimum	.7	4	1.7	8
Geum triflorum	.3	2		
Lappula redowskii	.1	1	.3	1
Linum perenne			T	
Lupinus spp.	.6	4	.2	1
Mertensia longifolia	T		T	
Myosotis alpestris	T		T	
Penstemon aridus	T			
Perideridia gairdneri	.2	1	.3	1
Phacelia heterophylla	.1	1	.3	1
Phlox longifolia	T		T	

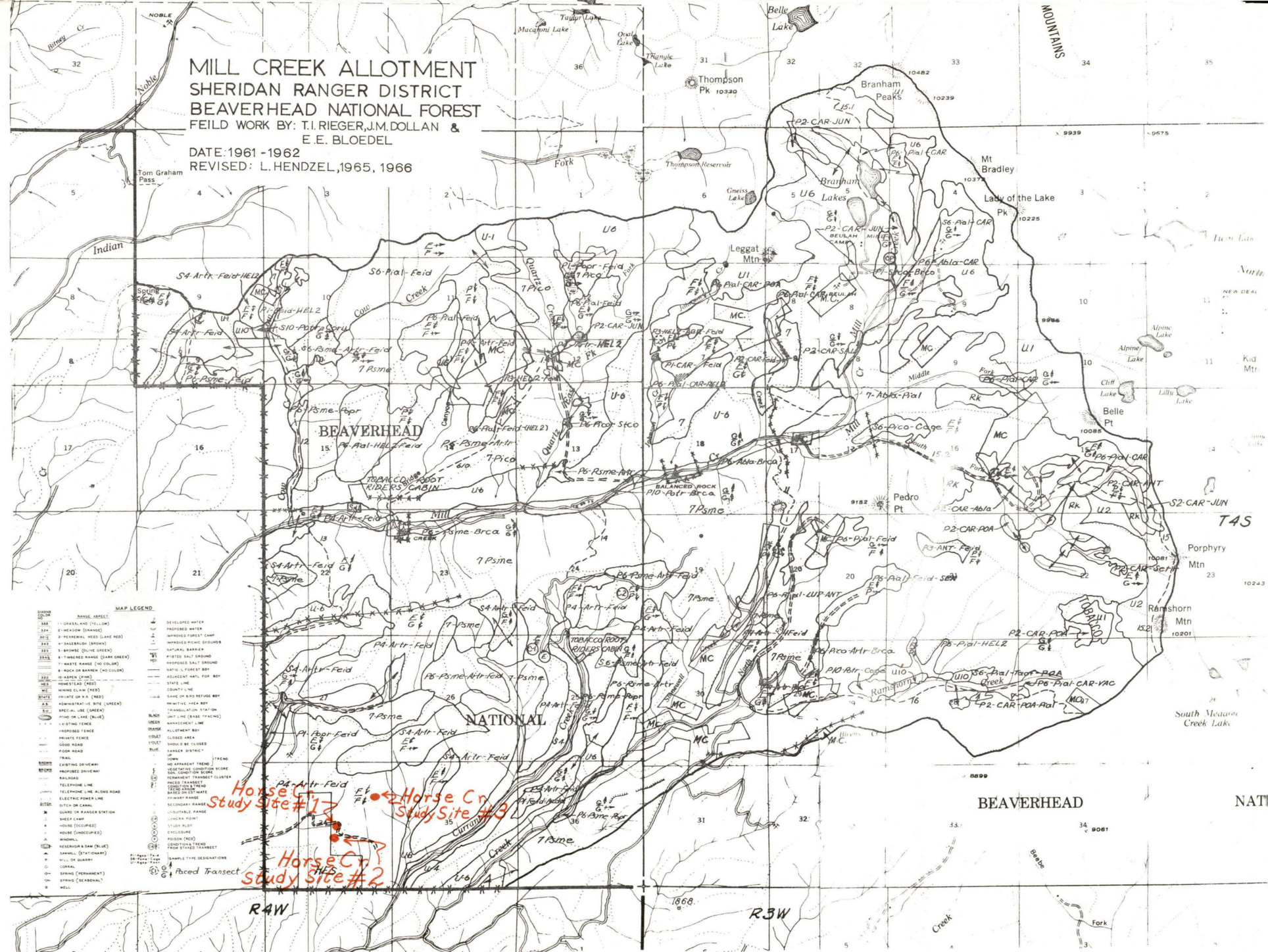
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Species	UNSPRAYED		SPRAYED	
	Ave. sq dm	Percent of	Ave. sq dm	Percent of
	per 20 sq dm	total veg.	per 20 sq dm	total veg.
	plot	cover	plot	cover
		%		%
Polygonum viviparum	.3	2	.9	4
Potentilla arguta	.1	1		
P. gracilis	.8	5	.3	1
Taraxacum laevigatum	.8	5	.5	2
Thalictrum occidentale	.1	1		
Tragopogon dubius			T	
Trifolium parryi			.2	1
Viola nuttallii	T		T	
Unidentified species			T	
(Total forb traces)	(.4)	(2)	(.2)	(1)
TOTAL FORBS	8.3	51	9.0	44
Artemisia tridentata	2.4	15	T	
Ribes montigenum	.5	3		
Symphoricarpos albus	.6	4	.2	1
Tetradymia canescens	T			
TOTAL SHRUBS	3.5	21	.2	1
Bare ground	.1		.1	

MILL CREEK ALLOTMENT SHERIDAN RANGER DISTRICT BEAVERHEAD NATIONAL FOREST

FIELD WORK BY: T.I. RIEGER, J.M. DOLLAN &
E.E. BLOEDEL
DATE: 1961-1962
REVISED: L. HENDZEL, 1965, 1966



HORSE CREEK

SITE NO. 1

Location: S34 T4S R4W

Soil: Clay loam, stony below
12 inches.

Sprayed: 1970

Sampled: June 29-July 1, 1971



General view

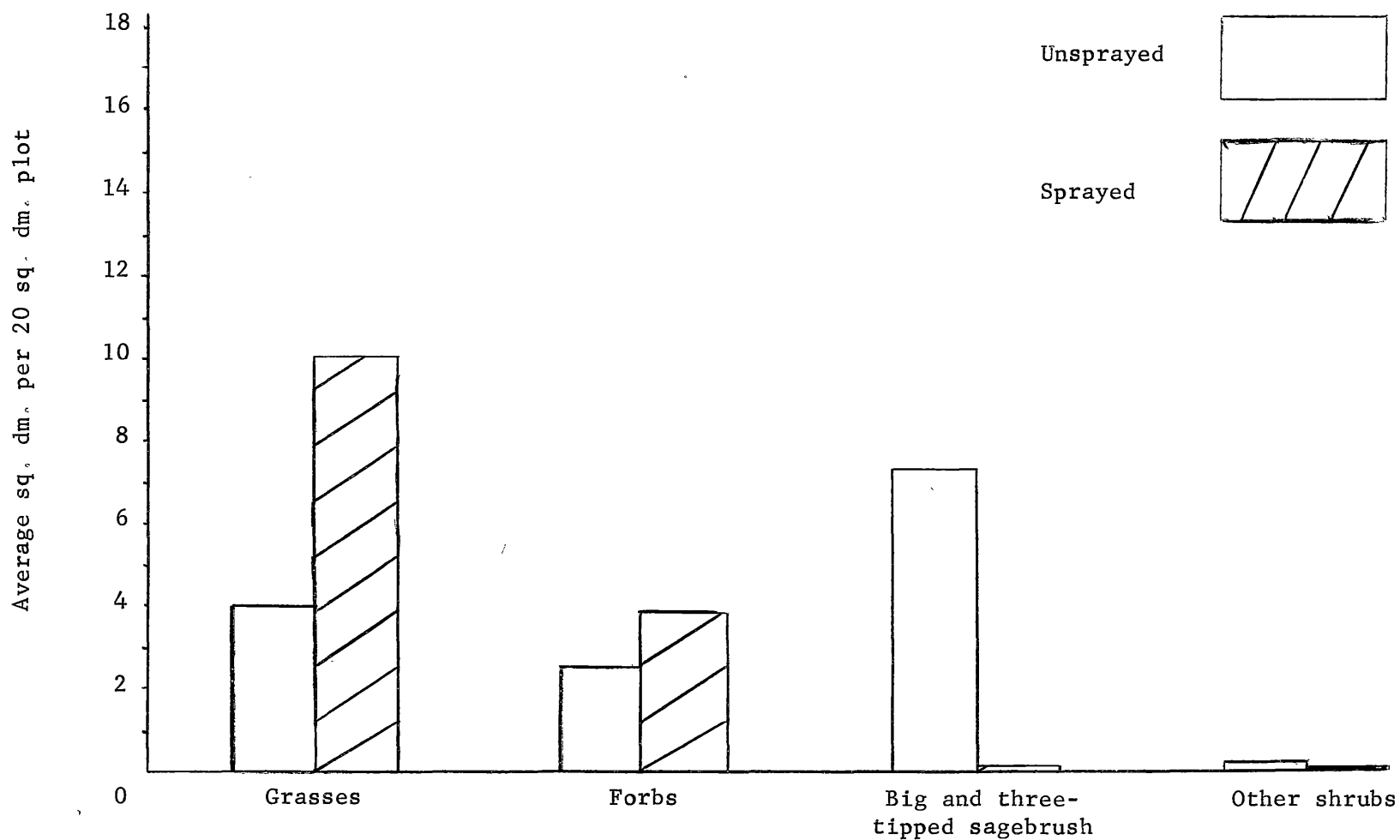


Unsprayed



Sprayed

Cover data for vegetation groupings on unsprayed and sprayed vegetation at Horse Creek, Site 1. Sprayed 1970. Sampled June 29-July 1, 1971.



Cover data for Horse Creek, Site 1, comparing unsprayed and sprayed
(1970) vegetation. Sampled June 29-July 1, 1971.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Agropyron spicatum	.2	1	1.0	7
Bromus marginatus	T			
Carex spp.	T		.1	1
Festuca idahoensis	.9	6	2.9	20
Poa sp.	2.7	19	5.3	37
Stipa comata	.2	1	.8	6
S. lettermanii			.1	1
TOTAL GRASSES AND SEDGES	4.0	28	10.1	72
Achillea millefolium	.2	1	.9	6
Agoseris glauca	T			
Antennaria rosea	.4	3	T	
Arabis holboellii	T		T	
Arenaria congesta	T		.4	3
Arnica fulgens	.1	1	.7	5
Collinsia parviflora	T			
Delphinium bicolor			.1	1
Dodecatheon conjugens			T	
Draba nemorosa	T		T	
Fritillaria atropurpurea	T		T	
Lithophragma parviflora	T		T	
Lupinus spp.	1.3	9	1.1	8
Mertensia oblongifolia	.1	1	.1	1
Phlox longifolia	T		.1	1
Sedum stenopetalum	T			
Senecio lugens			T	
Taraxacum laevigatum	.1	1	.1	1
Viola nuttallii	.2	1	.1	1
Unidentified species			T	
(Total forb traces)	(.2)	(1)	(.3)	(2)
TOTAL FORBS	2.6	18	3.9	28
Artemisia tridentata	7.5	53	.1	1
Chrysothamnus viscidiflorus	.2	1	T	
TOTAL SHRUBS	7.8	54	.1	1
Bare ground	.1			

Average production in grams per 20 sq dm plot and in percent on Horse Creek, Site 1, showing unsprayed and sprayed comparisons. Sampled June 29-July 1, 1971.

	UNSPRAYED		SPRAYED	
	Grams	Percent	Grams	Percent
Agropyron spicatum	.11	1	1.36	5
Carex spp.	.08	1	.01	
Festuca idahoensis	3.58	37	5.76	19
Poa sp.	4.03	41	12.28	42
Stipa comata	.35	4	2.88	10
S. lettermanii			.67	2
TOTAL GRASSES AND SEDGES	8.15	84	22.96	78
Achillea millefolium	.29	3	2.56	9
Arenaria congesta			.64	2
Arnica fulgens	.12	1	.69	2
Lupinus spp.	.85	9	2.08	7
Miscellaneous forbs	.31	3	.49	2
TOTAL FORBS	1.57	16	6.46	22
TOTAL PRODUCTION	9.72		29.42	

note: grams/plot X 44.6 = lbs/acre

HORSE CREEK

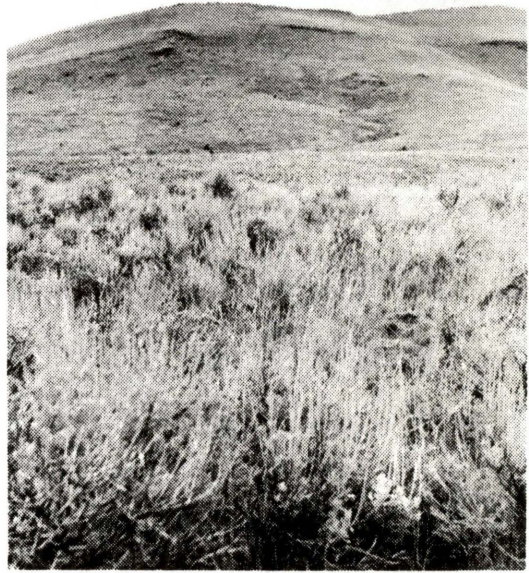
SITE NO. 2

Location: S34 T4S R4W

Soil: Clay loam, overlying
very gravelly to stony
soil below 7 inches.

Sprayed: 1970

Sampled: June 23-25, 1971



General view

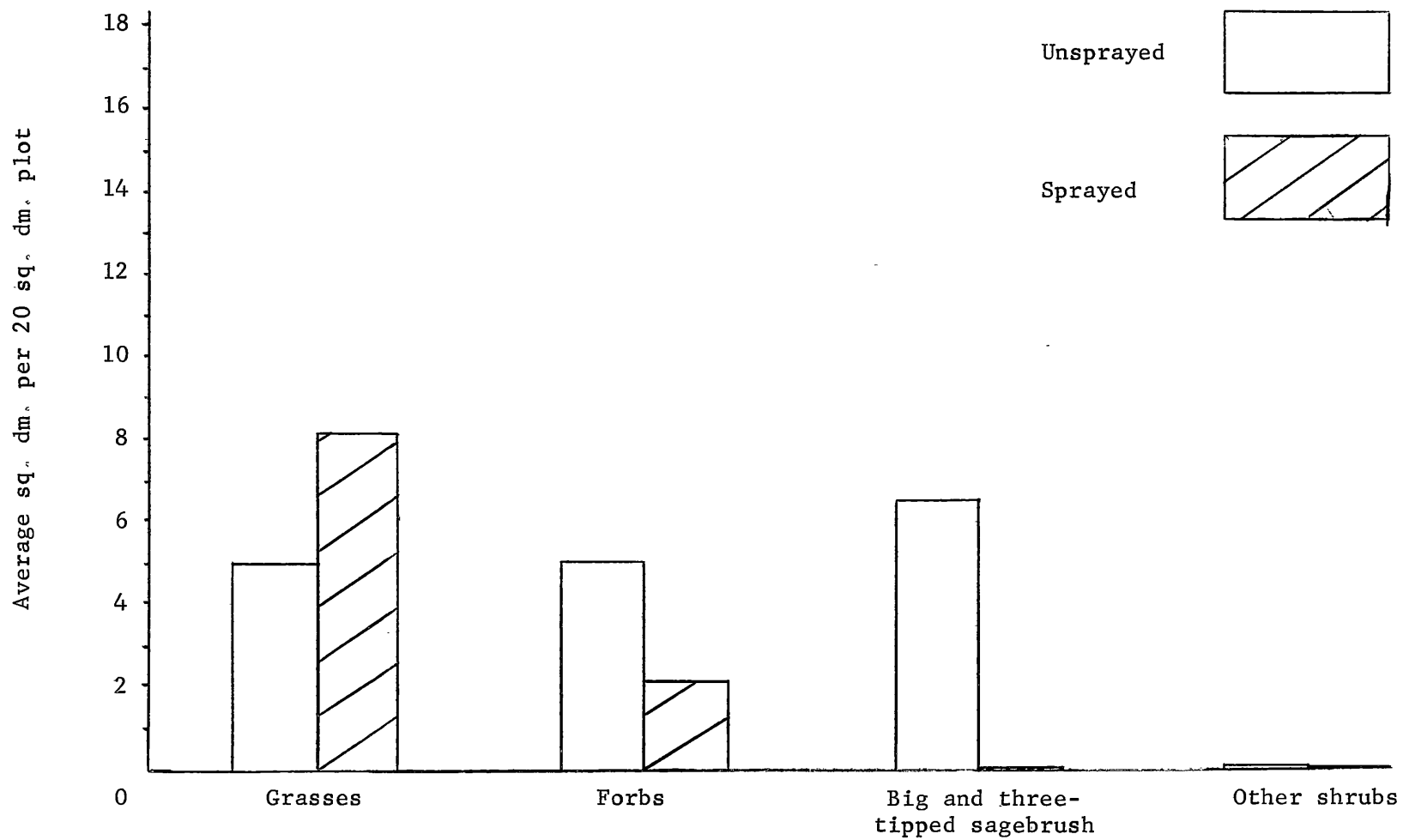


Unsprayed



Sprayed

Cover data for vegetation groupings on unsprayed and sprayed vegetation at Horse Creek, Site 2. Sprayed 1970. Sampled June 23-25, 1971.



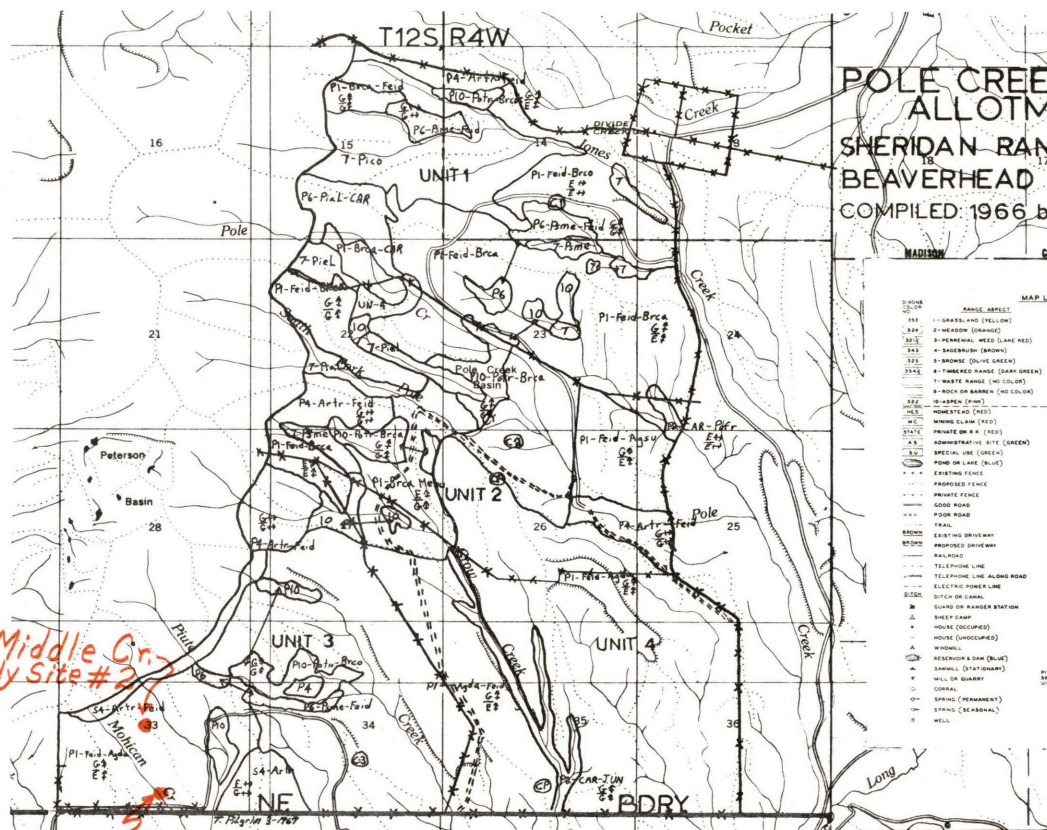
Cover data for Horse Creek, Site 2, comparing unsprayed and sprayed (1970) vegetation. Sampled June 23-25, 1971.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Agropyron spicatum	.2	1	1.1	11
Carex spp.	T		.1	1
Festuca idahoensis	3.8	23	5.1	49
Poa sp.	.8	5	1.4	13
Stipa comata	.2	1	.6	6
TOTAL GRASSES AND SEDGES	5.0	30	8.2	79
Achillea millefolium			.2	2
Agoseris glauca	.1	1		
Allium cernuum	.1	1		
Antennaria rosea	1.9	11	T	
Arabis holboellii	T			
Arenaria congesta	.7	4	.2	2
Arnica fulgens	T		.2	2
Besseyia wyomingensis	T		T	
Castilleja sp.	T			
Comandra umbellata	.1	1		
Delphinium bicolor	.2	1	.1	1
Dodecatheon conjugens	.1	1	T	
Draba nemorosa			.1	1
Fritillaria atropurpurea	.1	1	T	
Lomatium ambiguum	T			
Lupinus spp.	1.4	8	1.1	11
Mertensia oblongifolia	T		T	
Phlox longifolia	.2	1	.1	1
Sedum stenopetalum	.1	1	T	
Taraxacum laevigatum	T			
Viola nuttallii	T		T	
Zygadenus venenosus	T			
(Total forb traces)	(.1)	(1)	(.2)	(2)
TOTAL FORBS	5.1	30	2.2	21
Artemisia tridentata	6.5	39	T	
Chrysothamnus viscidiflorus	T		T	
TOTAL SHRUBS	6.6	39	T	
Bare ground	.2		.4	

Average production in grams per 20 sq dm plot and in percent on Horse Creek, Site 2, showing unsprayed and sprayed comparisons. Sampled June 23-25, 1971.

	UNSPRAYED		SPRAYED	
	Grams	Percent	Grams	Percent
Agropyron spicatum	.25	2	1.59	7
Carex spp.	.03			
Festuca idahoensis	6.46	55	14.77	68
Poa sp.	1.01	9	2.45	11
Stipa comata	.17	1	1.32	6
TOTAL GRASSES AND SEDGES	7.92	67	20.13	92
Arenaria congesta	.84	7	.51	2
Castilleja sp.	.41	4		
Comandra umbellata	.50	4		
Lupinus spp.	1.34	12	.54	3
Phlox longifolia	.38	3	.22	1
Miscellaneous forbs	.36	3	.35	2
TOTAL FORBS	3.83	33	1.62	8
TOTAL PRODUCTION	11.75		21.75	

note: grams/plot X 44.6 = lbs/acre



MAP LEGEND

SYMBOL	RANGE ABSTRACT	DEVELOPED WATER
1-1	GRASSLAND (YELLOW)	DEVELOPED WATER
2-1	WETLAND (ORANGE)	IMPROVED FOREST CAMP
3-1	PERMANENT WOOD (DARK RED)	IMPROVED FOREST GROUNDS
4-1	BARREN/BLANK (BROWN)	NATURAL BARRIER
5-1	BRUSH (OLIVE GREEN)	MIXED SALT GRASS
6-1	THICKET (DARK GREEN)	PROPOSED SALT GRASS
7-1	WASTE RANGE (NO COLOR)	NATIONAL FOREST BDT
8-1	ROCK OR BARREN (NO COLOR)	ADJACENT NATL. FOR. BDT
9-1	W-ASPEN (PINK)	STATE LINE
10-1	W-SPRUCE (RED)	COUNTY LINE
11-1	W-ELM (PINK)	GAME OR BIRD REFUGE BDT
12-1	PRIVATE OR A.A. (RED)	PRIMITIVE AREA BDT
13-1	ADMINISTRATIVE SITE (GREEN)	TRANSLATION STATION
14-1	SPECIAL USE (GREEN)	UNIT LINE (BASE TRACKS)
15-1	POND OR LAKE (BLUE)	MANAGEMENT LINE
16-1	EXISTING FENCE	UNIT LINE
17-1	PROPOSED FENCE	CLOSED AREA
18-1	PRIVATE FENCE	SHOULD BE CLOSED
19-1	GOOD ROAD	RANGER DISTRICT
20-1	POOR ROAD	DOWN
21-1	TRAIL	NO APPARENT TREND
22-1	EXIST NO DRIVEWAY	VEGETATION CONDITION SCORE
23-1	PROPOSED DRIVEWAY	50% LOWEST SCORE
24-1	RAILROAD	PERMANENT TRANSECT CLUSTER
25-1	TELEPHONE LINE	PERMANENT TRANSECT
26-1	TELEPHONE LINE ALONG ROAD	PERMANENT TRANSECT
27-1	ELECTRIC POWER LINE	PERMANENT TRANSECT
28-1	OTHER OR CANAL	PERMANENT TRANSECT
29-1	GUARD OR RANGER STATION	PERMANENT TRANSECT
30-1	SHEEP CAMP	PERMANENT TRANSECT
31-1	HOUSE (OCCUPIED)	PERMANENT TRANSECT
32-1	HOUSE (UNOCCUPIED)	PERMANENT TRANSECT
33-1	WINDMILL	PERMANENT TRANSECT
34-1	WINDMILL & DAM (BLUE)	PERMANENT TRANSECT
35-1	WELL (STATIONARY)	PERMANENT TRANSECT
36-1	WELL OR QUARRY	PERMANENT TRANSECT
37-1	CORRAL	PERMANENT TRANSECT
38-1	SPRING (PERMANENT)	PERMANENT TRANSECT
39-1	SPRING (SEASONAL)	PERMANENT TRANSECT
40-1	WELL	PERMANENT TRANSECT

MIDDLE CREEK

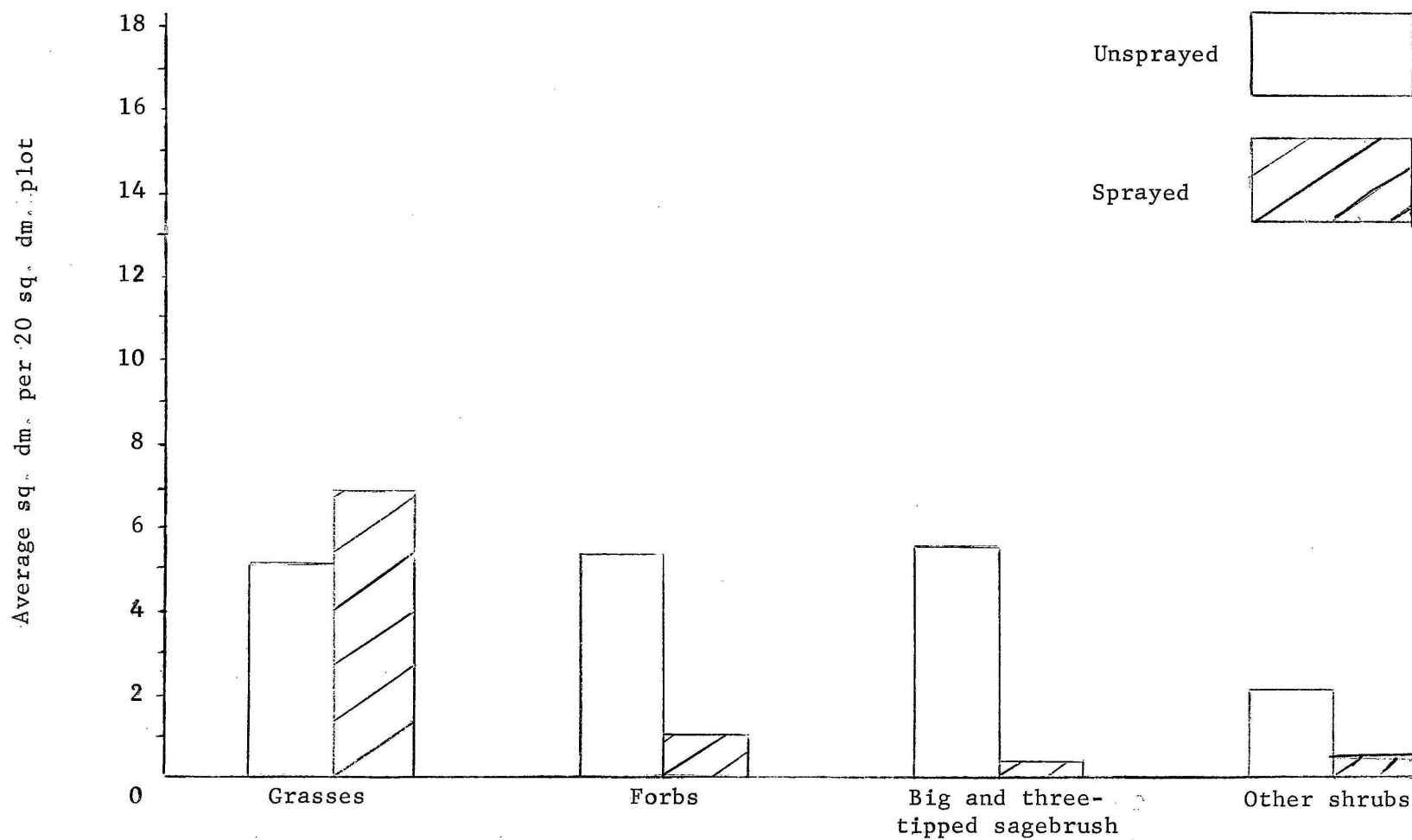
SITE NO. 1

Location: S33 T12S R4W

Sprayed: 1960

Sampled: July 29-August 2, 1970

Cover data for vegetation groupings on unsprayed and sprayed vegetation at Middle Creek, Site 1. Sprayed 1960. Sampled July 31-August 3, 1970.



Cover data for Middle Creek, Site 1, comparing unsprayed and sprayed (1960) vegetation. Sampled July 31-August 3, 1970.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover
		%		%
Agropyron dasystachyum	.4	2	1.4	15
A. spicatum			.4	4
Bromus marginatus	1.0	5	.6	7
Carex spp.	.4	2	.1	1
Festuca idahoensis	1.8	10	.6	7
Koeleria cristata			T	
Melica spectabilis	T		T	
Poa sp.	T		.5	6
Stipa columbiana	1.0	5	1.1	12
S. lettermannii	.1		.1	1
S. richardsonii	.2	1	2.2	24
TOTAL GRASSES AND SEDGES	5.1	28	7.0	78
Achillea millefolium	.1		T	
Androsace septentrionalis			T	
Antennaria rosea	.1			
Berberis repens	.4	2		
Clematis hirsutissima	T		T	
Eriogonum alpinum			.2	2
Eriogonum umbellatum	1.4	8		
Fragaria virginiana	.3	2		
Geranium viscosissimum	.2	1		
Lappula redowskii	.2	1	T	
Lupinus spp.	2.3	13	.8	9
Penstemon aridus	T			
Phlox longifolia	T			
Potentilla gracilis	T			
Polygonum sp.	.1			
Viola nuttallii	T		T	
Unidentified forbs	.1			
(Total forb traces)	(.2)	(1)	(.1)	(1)
TOTAL FORBS	5.4	29	1.1	12
Artemisia tridentata				
ssp. vaseyana	5.7	31	.4	4
Potentilla fruticosa	.1			
Rosa woodsii	.5	3	.5	6
Symphoricarpos albus	1.4	8		
TOTAL SHRUBS	7.8	43	.9	10

Average production in grams per 20 sq dm plot and in percent on Middle Creek, Site 1, showing unsprayed and sprayed comparisons. Sampled July 31-August 3, 1970.

Species	UNSPRAYED		SPRAYED	
	Grams	Percent	Grams	Percent
Agropyron dasystachyum	.54	2	3.82	10
A. spicatum			3.26	9
Bromus marginatus	1.58	6		
Carex spp.	.33	1	.29	1
Festuca idahoensis	4.77	19	2.60	7
Stipa columbiana	3.08	13	.78	2
S. lettermannii	.46	2		
S. richardsonii	3.88	16	11.52	31
Misc. perennial grasses and sedges	<u>3.01</u>	<u>12</u>	<u>11.39</u>	<u>31</u>
TOTAL GRASSES AND SEDGES	17.65	72	33.66	91
Antennaria rosea	.01	T		
Fragaria virginiana	.74	3		
Lappula redowskii			.30	1
Lupinus spp.	5.37	22	.37	1
Potentilla gracilis			1.89	5
Miscellaneous forbs	<u>.72</u>	<u>3</u>	<u>.60</u>	<u>2</u>
TOTAL FORBS	6.84	28	3.16	9
TOTAL PRODUCTION	24.49		36.82	

note: grams/plot X 44.6 = lbs/acre

MIDDLE CREEK

SITE NO. 2

Location: S33 T12S R4W

Soil: Clay loam with 5-10%
stone. pH 7.0

Sprayed: 1960

Sampled: August 3-4, 1972

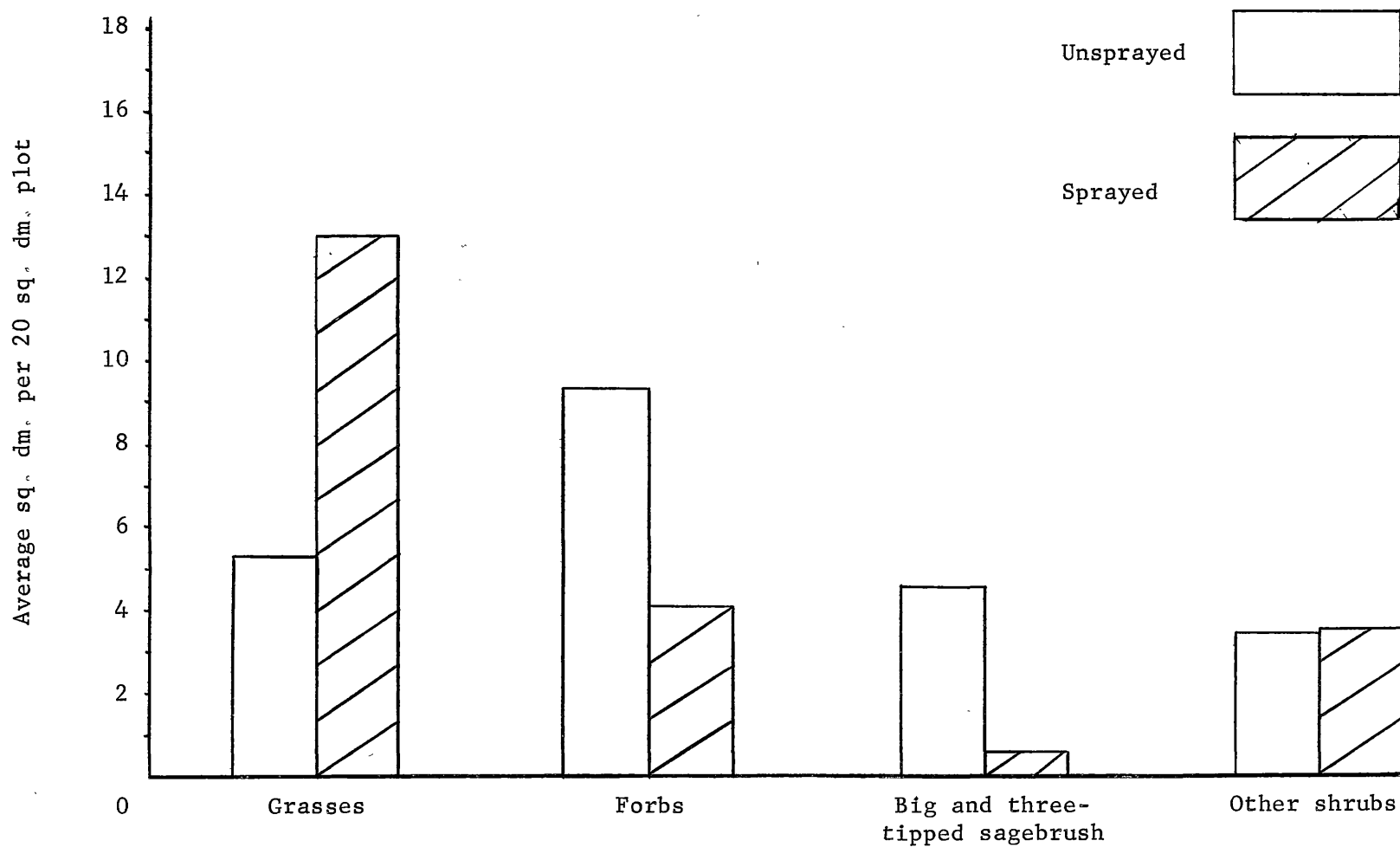


Unsprayed



Sprayed

Cover data for vegetation groupings on unsprayed and sprayed vegetation at Middle Creek, Site 2. Sprayed 1960. Sampled August 3, 1972.



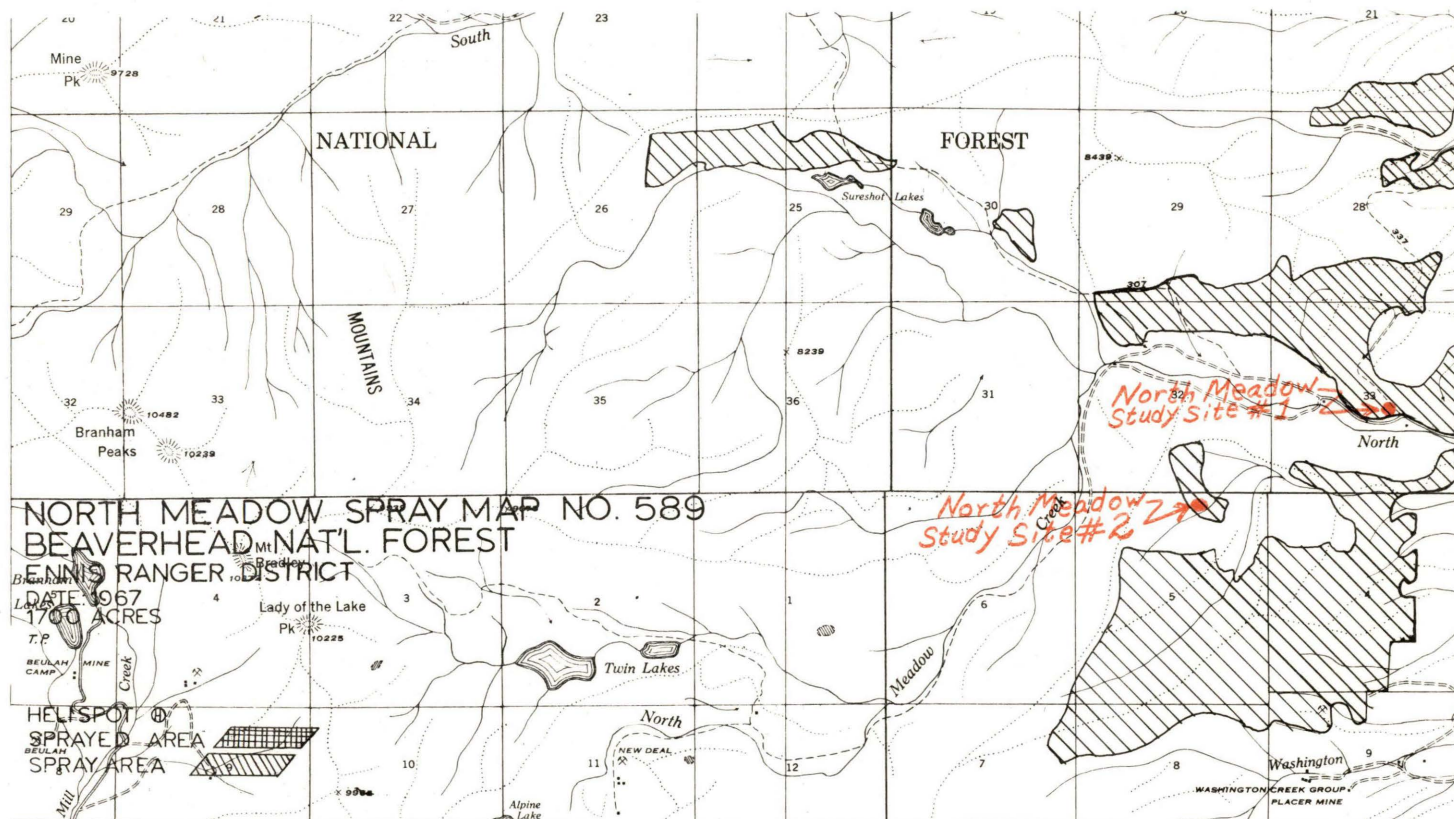
Cover data for Middle Creek, Site 2, comparing unsprayed and sprayed (1960) vegetation. Sampled August 3, 1972.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Agropyron repens	.1		.3	1
A. spicatum			.1	
Bromus anomalus			.1	
B. marginatus	2.7	12	8.5	40
B. pumpellianus	.4	2		
Carex spp.	.3	1	1.7	8
Festuca idahoensis	.9	4	.7	3
Koeleria cristata	T			
Melica bulbosa	.1		T	
Poa sp.	.4	2	1.2	6
Stipa columbiana	.3	1	.4	2
TOTAL GRASSES AND SEDGES	5.3	23	13.0	61
Achillea millefolium	.4	2	.6	3
Antennaria rosea	.1			
Arabis holboellii	T		T	
A. nuttallii	T		T	
Cerastium nutans	T		.1	
Clematis hirsutissima	.2	1	.1	
Collomia linearis	T		T	
Comandra umbellata	T			
Erigeron sp.	1.0	4	.3	1
Erysimum sp.			T	
Galium boreale	.2	1	.1	
Geranium viscosissimum	1.5	7	.6	3
Geum triflorum	.3	1	.1	
Helianthus annuus	1.4	6	.3	1
Lappula redowskii	1.2	5	1.0	5
Lomatium triternatum	T			
Lupinus spp.	.2	1	.1	
Mertensia oblongifolia	.1		T	
Myosotis alpestris			T	
Penstemon aridus			.1	
Phacelia heterophylla	T			
Phlox longifolia	T			
Polygonum viviparum	T		T	
Potentilla arguta	.4	2		
P. gracilis	2.1	9	.4	2
Rumex paucifolius	T			
Thalictrum occidentale			.1	
Viola nuttallii	T		T	
(Total forb traces)	(.2)	(1)	(.2)	(1)
TOTAL FORBS	9.3	41	4.1	19

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Species	UNSPRAYED		SPRAYED	
	Ave. sq dm	Percent of	Ave. sq dm	Percent of
	per 20 sq dm	total veg.	per 20 sq dm	total veg.
	plot	cover	plot	cover
		%		%
Artemisia tridentata	4.6	20	.6	3
Berberis repens	.6	3	.3	1
Rosa woodsii	.8	3	1.9	9
Symphoricarpos albus	<u>2.0</u>	<u>9</u>	<u>1.3</u>	<u>6</u>
TOTAL SHRUBS	8.0	35	4.1	19
Bare ground	.2		.3	



NORTH MEADOW

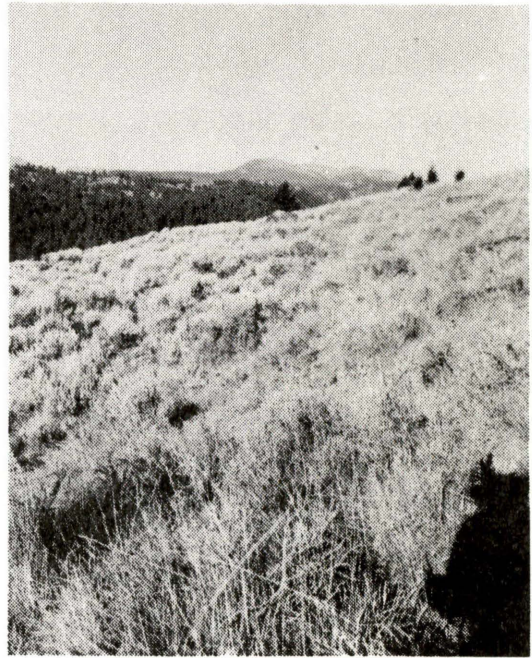
SITE NO. 1

Location: S33 T3S R2W

Soil: Sandy clay (pH 6.5)
very stony material
below 9 inches.

Sprayed: 1968

Sampled: August 3-10, 1971



General view

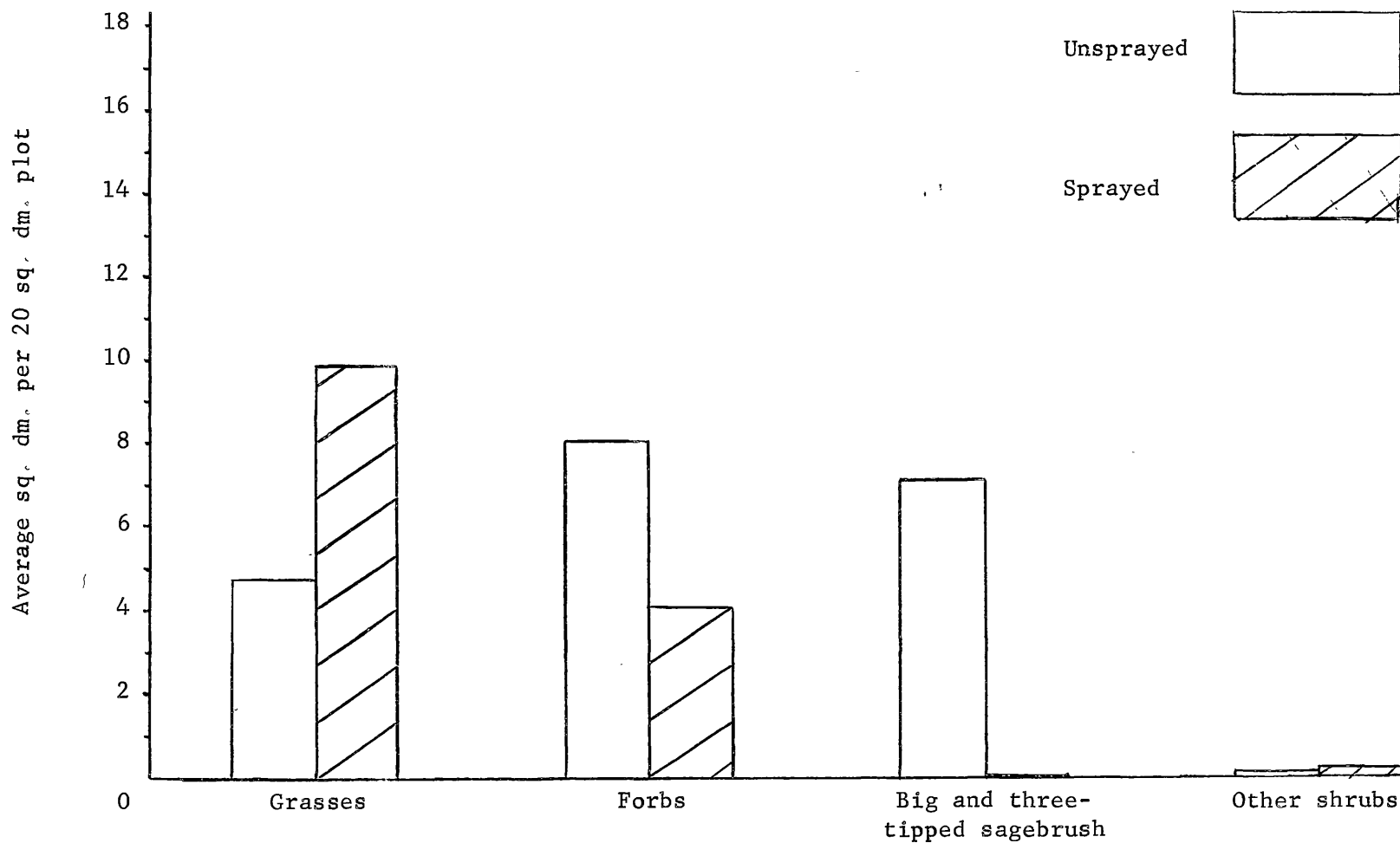


Unsprayed



Sprayed

Cover data for vegetation groupings on unsprayed and sprayed vegetation at North Meadow Creek, Site 1. Sprayed 1968. Sampled August 3-10, 1971.



Cover data for North Meadow Creek, Site 1, comparing unsprayed and sprayed (1968) vegetation. Sampled August 3-10, 1971.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm	Percent of	Ave. sq dm	Percent of
	per 20 sq dm plot	total veg. cover %	per 20 sq dm plot	total veg. cover %
Agropyron spicatum	1.9	9	3.0	21
Bromus marginatus	.3	1	.2	1
B. tectorum	.4	2	.8	6
Carex spp.	.1		.1	1
Elymus cinereus			.1	1
Festuca idahoensis	1.4	7	1.7	12
Koeleria cristata	T		.2	1
Phleum pratense			T	
Poa sp.	.3	1	2.0	14
Stipa comata	.3	1	1.6	11
TOTAL GRASSES AND SEDGES	4.7	24	9.8	69
Achillea millefolium	.7	3	.6	4
Allium sp.	T			
Antennaria rosea	1.6	8	T	
Arabis holboellii	T		T	
Arnica fulgens	.3	1	T	
Aster sp.	T		T	
Balsamorhiza sagittata	.9	4		
Cerastium arvense			T	
Clematis hirsutissima	T			
Collinsia parviflora	.1		.1	1
Collomia linearis	.2	1	.4	3
Comandra umbellata	.2	1	.1	1
Delphinium bicolor			T	
Draba nemorosa	T		T	
Eriogonum alpinum	.6	3		
Erysimum inconspicuum			.1	1
Fritillaria atropurpurea	T			
Geranium viscosissimum	.1		.6	4
Helianthella uniflora	.4	2	T	
Hieracium scouleri	.1			
Lactuca ludoviciana			T	
Lithophragma parviflora	T		T	
Lithospermum pilosum	.2	1		
Lupinus spp.	2.0	10	1.2	8
Microseris nutans	.1		.1	1
Myosotis sylvatica			T	
Phlox longifolia	.2	1	.1	1
Polygonum aviculare	.1		.1	1
Potentilla arguta	T		T	
Taraxacum laevigatum	T		.1	1

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Species	UNSPRAYED		SPRAYED	
	Ave. sq dm	Percent of	Ave. sq dm	Percent of
	per 20 sq dm	total veg.	per 20 sq dm	total veg.
	plot	cover	plot	cover
		%		%
Thlaspi arvense			T	
Tragopogon dubius	.2	1	.4	3
(Total forb traces)			(.1)	(1)
TOTAL FORBS	<u>8.0</u>	<u>40</u>	<u>4.0</u>	<u>28</u>
Artemisia ludoviciana	.1		.2	1
A. tridentata	7.1	36	T	
Prunus virginiana	<u>T</u>	<u>36</u>	<u>.3</u>	<u>2</u>
TOTAL SHRUBS	7.2			
Bare ground	.8		.3	

Average production in grams per 20 sq dm plot and in percent on North Meadow Creek, Site 1, showing unsprayed and sprayed comparisons. Sampled August 3-10, 1971.

	UNSPRAYED		SPRAYED	
	Grams	Percent	Grams	Percent
Agropyron spicatum	6.56	22	12.29	26
Bromus marginatus	.30	1	1.21	3
B. tectorum	.16	1	.88	2
Festuca idahoensis	2.53	9	7.33	15
Koeleria cristata	.09		.71	1
Poa sp.	1.01	3	7.52	16
Stipa comata	1.24	4	8.29	17
TOTAL GRASSES AND SEDGES	11.89	40	38.23	80
Achillea millefolium	1.30	5	1.61	3
Arnica fulgens	.47	2		
Balsamorhiza sagittata	2.32	8		
Collomia linearis	.35	1	.97	2
Comandra umbellata	1.34	5	.03	
Erysimum inconspicuum			1.68	4
Geranium viscosissimum	.03		.59	1
Helianthella uniflora	.40	1		
Lupinus spp.	7.78	26	2.15	5
Phlox longifolia	.35	1	.14	
Polygonum aviculare	.13		.70	1
Tragopogon dubius	2.91	10	1.25	3
Miscellaneous forbs	.37	1	.40	1
TOTAL FORBS	17.75	60	9.52	20
TOTAL PRODUCTION	29.64		47.75	

note: grams/plot X 44.6 = lbs/acre

NORTH MEADOW

SITE NO. 2

Location: S32 T3S R2W

Sprayed: 1968

Sampled: August 11-19, 1971



General view

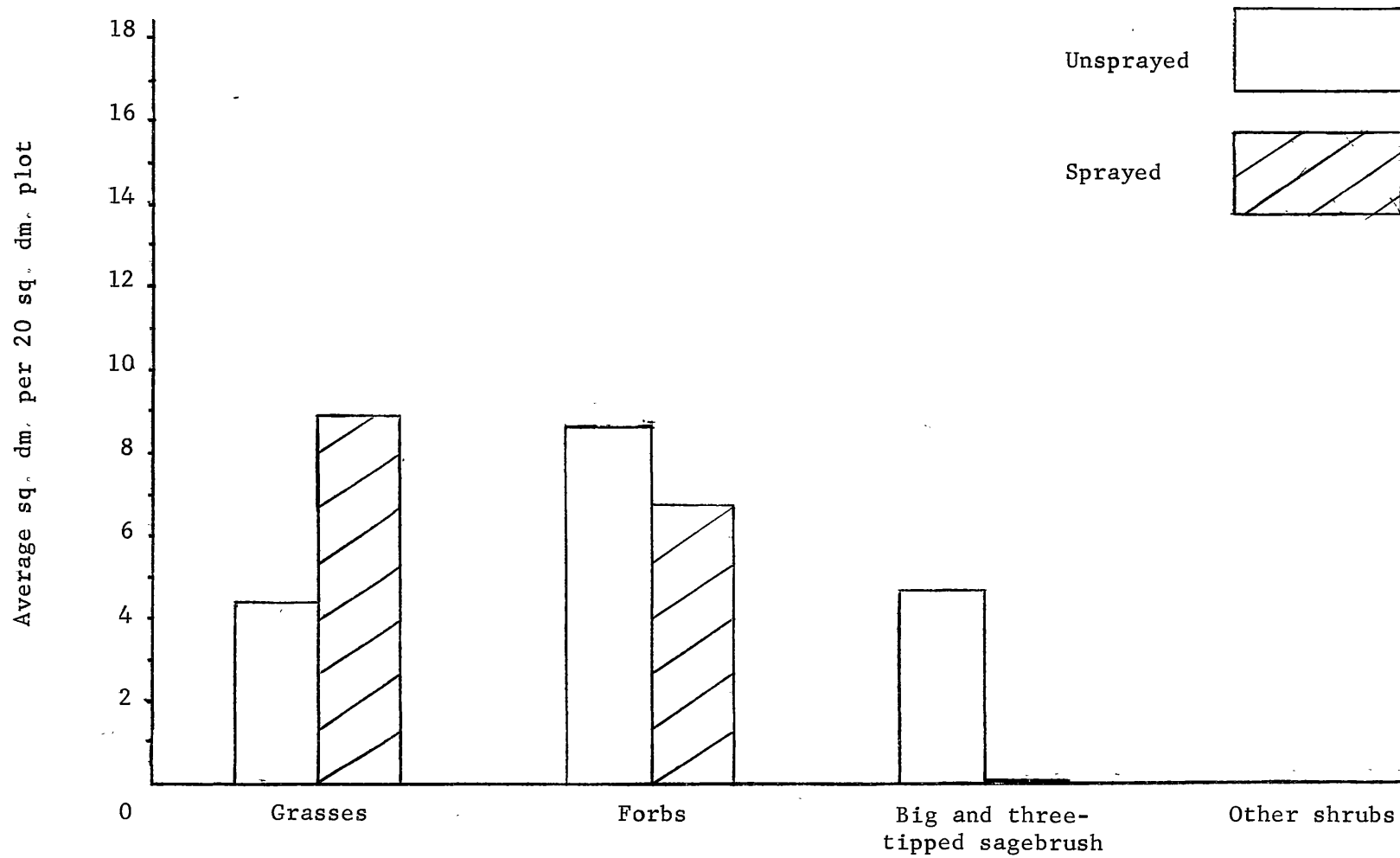


Unsprayed



Sprayed

Cover data for vegetation groupings on unsprayed and sprayed vegetation at North Meadow Creek, Site 2. Sprayed 1968. Sampled August 11-19, 1971.



Cover data for North Meadow Creek, Site 2, comparing unsprayed and sprayed (1968) vegetation. Sampled August 11-19, 1971.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Agropyron dasystachyum	.4	3	1.1	7
A. spicatum			.9	6
Bromus marginatus	.6	3	1.7	11
Carex spp.	1.6	9	1.6	10
Danthonia unispicata	T		T	
Festuca idahoensis	.3	2	1.3	8
Koeleria cristata	T		.1	1
Melica bulbosa	.2	1	.1	1
Phleum pratense	.1	1	.1	1
Poa sp.	.9	5	.9	6
Sporobolus airoides	.2	1	.1	1
Stipa comata	.1	1	.9	6
TOTAL GRASSES AND SEDGES	4.4	25	8.9	57
Achillea millefolium	.5	3	.1	1
Agoseris glauca	.1	1		
Antennaria rosea	T			
Arenaria congesta			.4	3
Campanula rotundifolia	.1	1	.1	1
Cerastium arvense	T		T	
Clematis hirsutissima	.5	3	T	
Collinsia parviflora			T	
Collomia linearis	.2	1	1.3	8
Delphinium bicolor	T		.2	1
D. occidentale	.1	1	.2	1
Draba nemorosa			T	
Epilobium paniculatum			T	
Erysimum inconspicuum	T		T	
Galium boreale	.4	2	T	
Geranium viscosissimum	.6	3	1.0	6
Geum triflorum	.2	1		
Helianthella uniflora	T			
Hieracium scouleri			T	
Lactuca ludoviciana	T			
Lappula redowskii	2.9	17	.1	1
Lithophragma parviflora	T		T	
Lomatium triternatum	.1	1	.3	2
Lupinus spp.	T		1.6	10
Mertensia oblongifolia			T	
Phlox longifolia	.1	1	T	
Polygonum aviculare	.4	2	1.0	6
Potentilla arguta	.3	2	T	
P. gracilis	1.3	7	.1	1

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(Continued).

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm	Percent of	Ave. sq dm	Percent of
	per 20 sq dm	total veg.	per 20 sq dm	total veg.
	plot	cover	plot	cover
		%		%
Taraxacum laevigatum	.2	1	T	
Thlaspi arvense	T		.1	1
Tragopogon dubius	.1	1	T	
Viola nuttallii	T		T	
(Total forb traces)	(.2)	(1)	(.2)	(1)
TOTAL FORBS	8.3	48	6.7	43
Artemisia tridentata	4.6	27	T	
TOTAL SHRUBS	4.6	27	T	

Average production in grams per 20 sq dm plot and in percent on North Meadow Creek, Site 2, showing unsprayed and sprayed comparisons. Sampled August 11-19, 1971.

	UNSPRAYED		SPRAYED	
	Grams	Percent	Grams	Percent
Agropyron dasystachyum	2.50	9	4.58	10
A. spicatum			8.89	19
Bromus marginatus	1.23	5	8.31	18
Carex spp.	3.94	14	3.04	6
Festuca idahoensis	.54	2	3.36	7
Poa sp.	3.05	11	2.63	6
Stipa comata	.87	3	2.73	6
Miscellaneous perennial grasses and sedges	.67	2	.27	
TOTAL GRASSES AND SEDGES	12.80	46	33.81	72
Achillea millefolium	.47	2	.06	
Arenaria congesta			.86	2
Campanula rotundifolia	.49	2	.36	1
Clematis hirsutissima	.72	3	.21	
Collomia linearis	.10		2.08	4
Delphinium bicolor			.30	1
Erysimum inconspicuum	.33	1	.24	1
Galium boreale	.80	3	.05	
Geranium viscosissimum	.86	3	.60	1
Lappula redowskii	5.47	20		
Lomatium triternatum	.23	1	1.52	3
Lupinus spp.	.23	1	3.72	8
Polygonum aviculare	.40	1	2.73	6
Potentilla arguta	.56	2	.04	
	3.09	11	.22	
Thlaspi arvense			.39	1
Tragopogon dubius	.35	1		
Miscellaneous forbs	.95	3	.28	
TOTAL FORBS	15.05	54	13.66	28
TOTAL PRODUCTION	27.85		47.47	

note: grams/plot X 44.6 = lbs/acre

NORTH SADDLE

SITE NO. 1

Location: S30 T13S R2E

Soil: Clay loam overlying
very gravelly to stony
soil at 9 inches.

Sprayed: 1970

Sampled: June 12-13, 1972



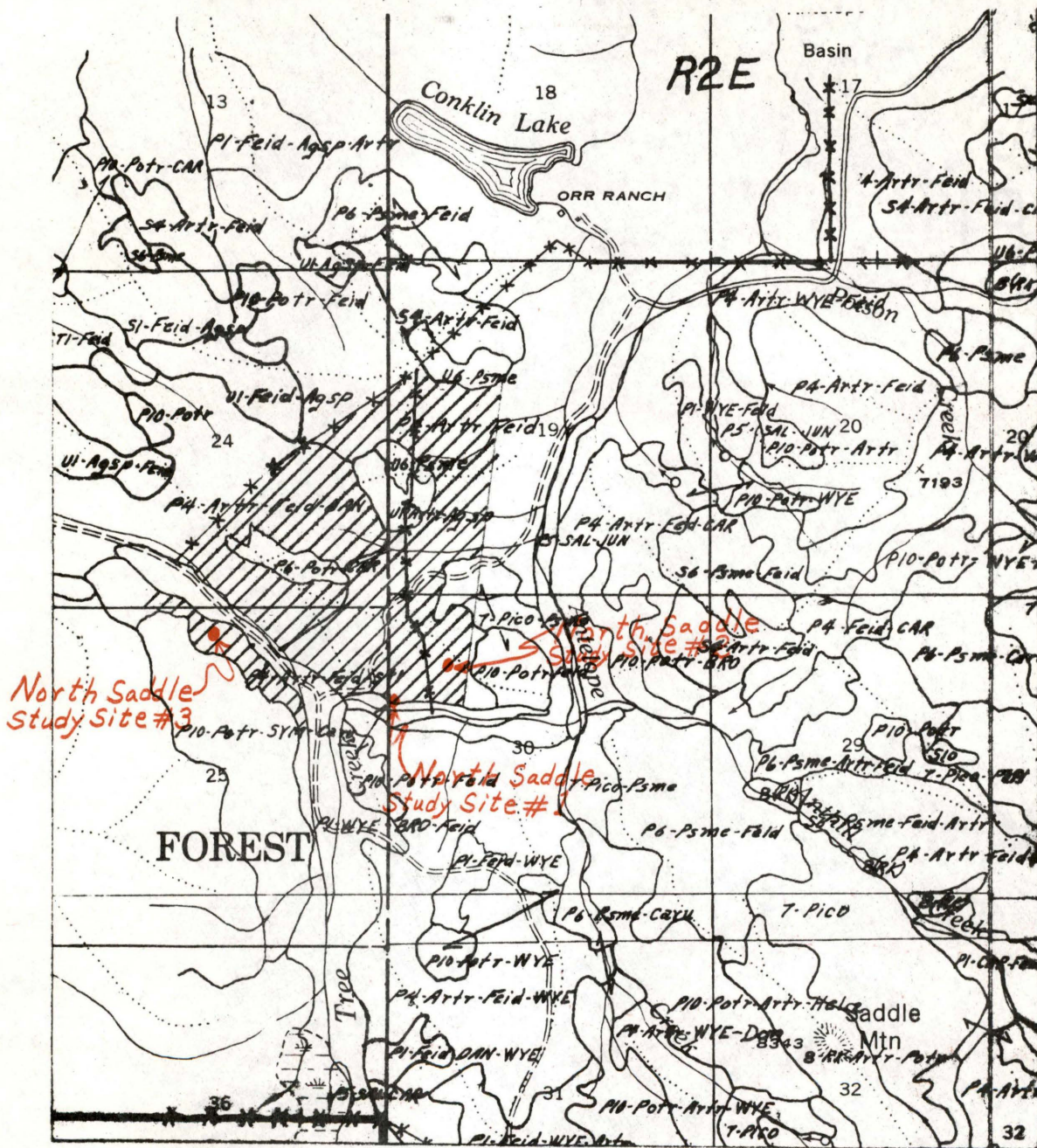
General view




Unsprayed



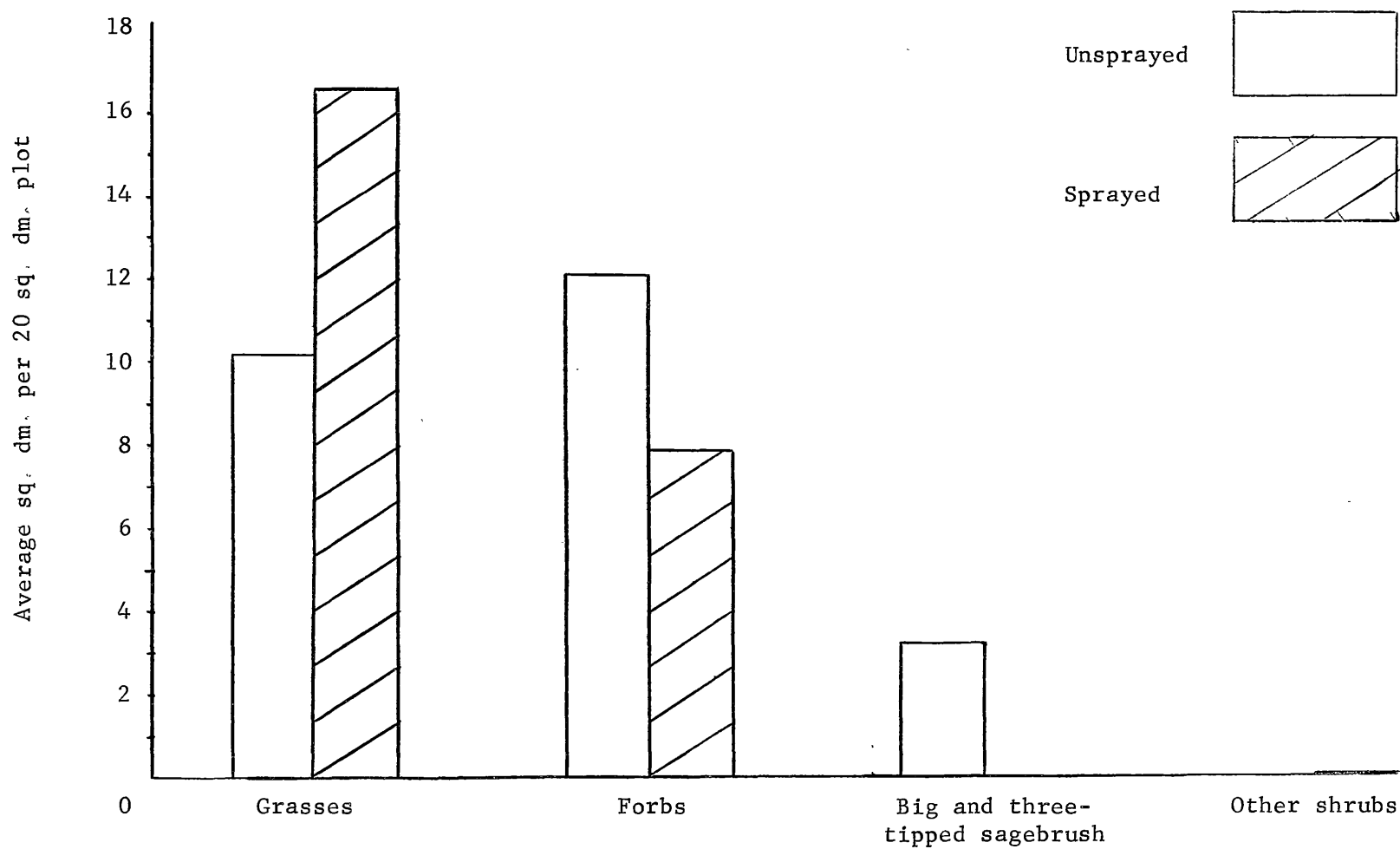
Sprayed



NORTH SADDLE No.624
MADISON RANGER DIST.
BEAVERHEAD NATIONAL FOREST

 Area Sprayed For Sagebrush
Control June 1970

Cover data for vegetation groupings on unsprayed and sprayed vegetation at North Saddle, Site 1. Sprayed 1970. Sampled June 12-13, 1972.



Cover data for North Saddle, Site 1, comparing unsprayed and sprayed (1970) vegetation. Sampled June 12-13, 1972.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Agropyron spicatum	1.0	4	3.4	14
Bromus inermis	.3	1		
B. marginatus	1.9	7	.9	4
Carex spp.	1.3	5	1.6	6
Festuca idahoensis	1.8	7	4.4	18
Phleum alpinum	.8	3	.5	2
Poa sp.	1.5	6	3.6	15
Stipa comata	1.6	6	2.2	9
TOTAL GRASSES AND SEDGES	10.2	40	16.6	68
Achillea millefolium	1.6	6	1.2	5
Agoseris glauca	.9	3	T	
Anemone cernua	T		T	
Antennaria rosea	T		T	
Arabis holboellii	T			
A. nuttallii	T			
Arenaria congesta			T	
Arnica fulgens	.2	1	.5	2
A. sororia			T	
Campanula rotundifolia			.1	
Cerastium nutans	.1		T	
Cirsium vulgare	T			
Clematis hirsutissima	.2	1		
Collinsia parviflora	.5	2		
Collomia linearis	.1		T	
Dodecatheon conjugens			T	
Draba nemorosa	.2	1		
Erigeron alpinus	.1		.6	2
Fragaria virginiana	1.0	4	1.9	8
Fritillaria atropurpurea	.6	2	.1	
Geranium viscosissimum	1.0	4	.3	1
Geum triflorum	.3	1		
Lappula redowskii	.6	2		
Lupinus spp.	.4	2	.6	2
Mertensia alpina	T		T	
Microseris nutans	T			
Phacelia franklinii	T			
Phlox longifolia	T		.1	
Potentilla arguta	.5	2	T	
P. gracilis	1.3	5	.2	1
Ranunculus glaberrimus	.3	1	.5	2
Rumex paucifolius	.2	1	.1	
Senecio lugens			T	

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Species	UNSPRAYED		SPRAYED	
	Ave. sq dm	Percent of	Ave. sq dm	Percent of
	per 20 sq dm	total veg.	per 20 sq dm	total veg.
	plot	cover	plot	cover
		%		%
Smilacina stellata			.3	1
Taraxacum laevigatum	1.8	7	1.1	4
Viola nuttallii	T		T	
(Total forb traces)	(.2)	(1)	(.2)	(1)
TOTAL FORBS	12.1	47	7.8	32
Artemisia ludoviciana			T	
A. tridentata	3.2	12		
TOTAL SHRUBS	3.2	12	T	
Bare ground	T			

NORTH SADDLE

SITE NO. 2

Location: S30 T13S R2E

Soil: Clay loam to sandy clay
overlying stony and
gravelly clay loam at
10 inches.

Sprayed: 1970

Sampled: June 27-29, 1972



General view

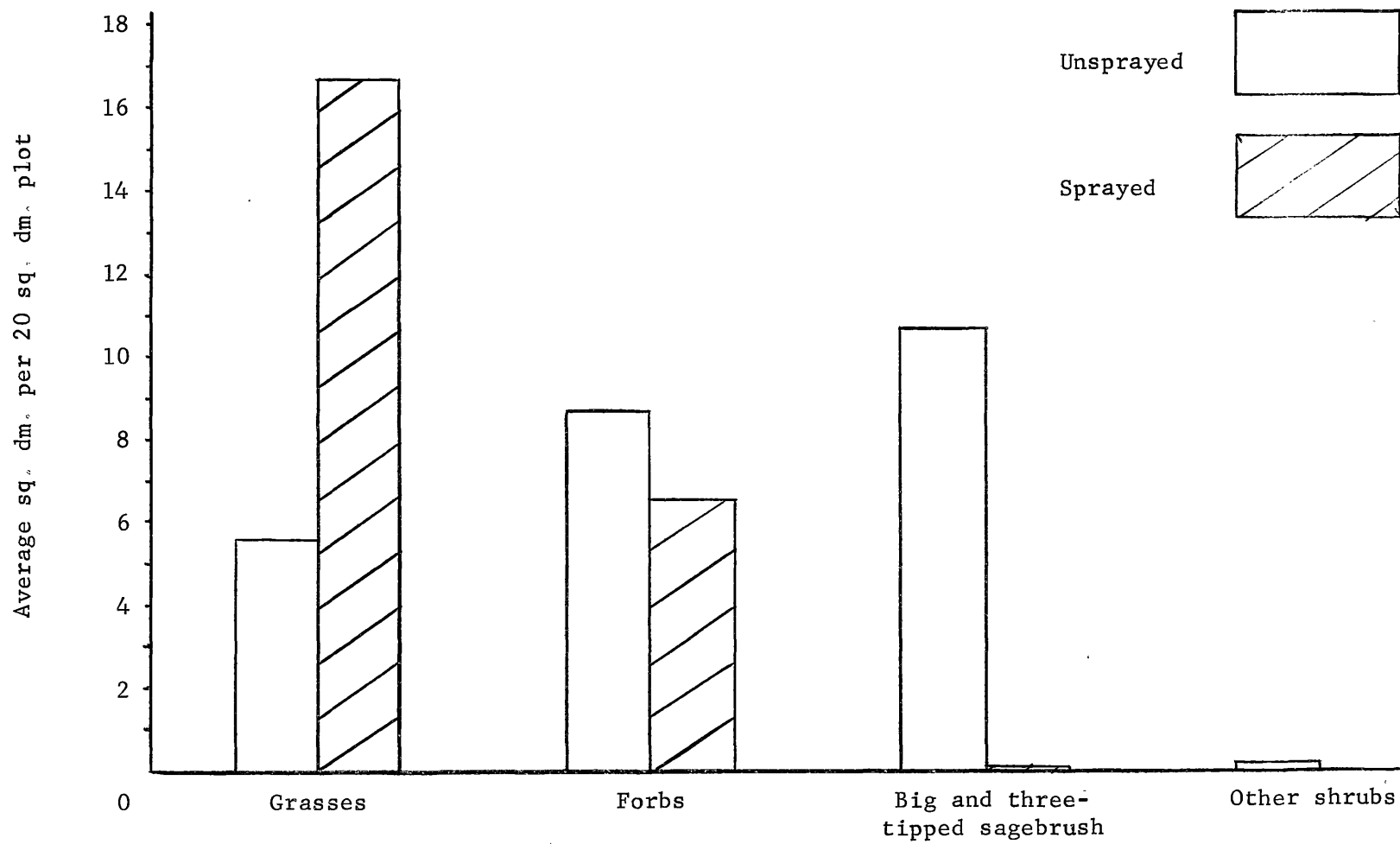


Unsprayed



Sprayed

Cover data for vegetation groupings on unsprayed and sprayed vegetation at North Saddle, Site 2. Sprayed 1970. Sampled June 27-29, 1972.



Cover data for North Saddle, Site 2, comparing unsprayed and sprayed (1970) vegetation. Sampled June 27-29, 1972.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Agropyron smithii	.1		.1	
A. spicatum	1.1	4	3.4	15
Bromus marginatus	.8	3	1.5	6
Carex spp.	.2	1	1.0	4
Danthonia intermedia	T		.1	
Festuca idahoensis	1.5	6	5.3	23
Koeleria cristata	.3	1	1.7	7
Poa sp.	1.0	4	1.9	8
Stipa comata	.5	2	1.7	7
TOTAL GRASSES AND SEDGES	5.6	22	16.7	72
Achillea millefolium	.7	3	.9	4
Agoseris glauca	T		.1	
Anaphalis margaritacea	.1		T	
Antennaria rosea	.2	1	T	
Arabis holboellii	.1		T	
Arenaria congesta	.2	1	T	
Arnica fulgens	.3	1	.5	2
Astragalus miser	.2	1	.1	
Besseyia wyomingensis	.2	1	.1	
Campanula rotundifolia			T	
Clematis hirsutissima	.1		.1	
Collinsia parviflora	T		T	
Collomia linearis	.1		T	
Dodecatheon conjugens	.1		.1	
Erigeron alpinus	1.8	7	.7	3
Erysimum asperum			T	
Geranium viscosissimum			T	
Geum triflorum	.2	1	.1	
Helianthus annuus	.3	1	.6	3
Heuchera parviflora	.2	1	T	
Lappula redowskii	.8	3	.3	1
Lithophragma parviflora	T			
Lupinus spp.	1.4	5	.7	3
Mertensia oblongifolia	T		T	
Microseris nutans			T	
Penstemon aridus			.1	
Phacelia heterophylla	.1			
Phlox longifolia	.1		T	
Potentilla arguta	.1			
P. gracilis	.5	2	.9	4
Ranunculus glaberrimus	.1		.1	
Rumex paucifolius			.1	
Senecio canus	.3	1	.1	

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Species	UNSPRAYED		SPRAYED	
	Ave. sq dm	Percent of	Ave. sq dm	Percent of
	per 20 sq dm	total veg.	per 20 sq dm	total veg.
	plot	cover	plot	cover
		%		%
Taraxacum laevigatum	.2	1	.5	2
Tragopogon dubius	T		.1	
Viola nuttallii	.2	1	T	
Zygadenus venenosus	T			
(Total forb traces)	(.1)		(.3)	(1)
TOTAL FORBS	8.7	34	6.5	28
Artemisia tridentata	10.7	42	.1	
Symphoricarpos albus	.2	1		
TOTAL SHRUBS	10.9	43	.1	
Bare ground	.1		T	

NORTH SADDLE

SITE NO. 3

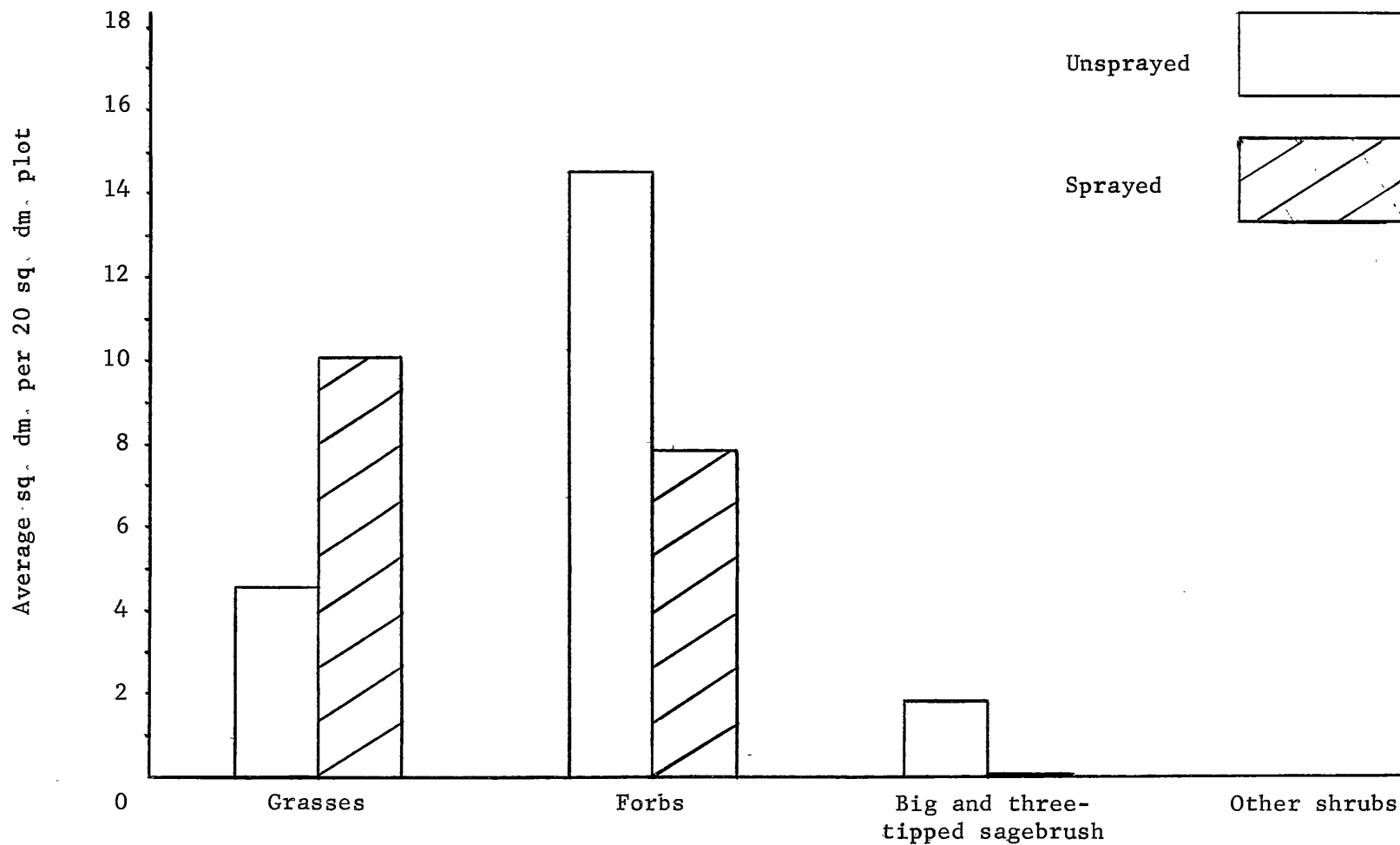
Location: S25 T13S R1E

Soil: Gravelly clay loam
overlying very large
stones at 10 inches.

Sprayed: 1970

Sampled: June 14-15, 1972

Cover data for vegetation groupings on unsprayed and sprayed vegetation at North Saddle, Site 3. Sprayed 1970. Sampled June 14-15, 1972.



Cover data for North Saddle, Site 3, comparing unsprayed and sprayed (1970) vegetation. Sampled June 14-15, 1972.

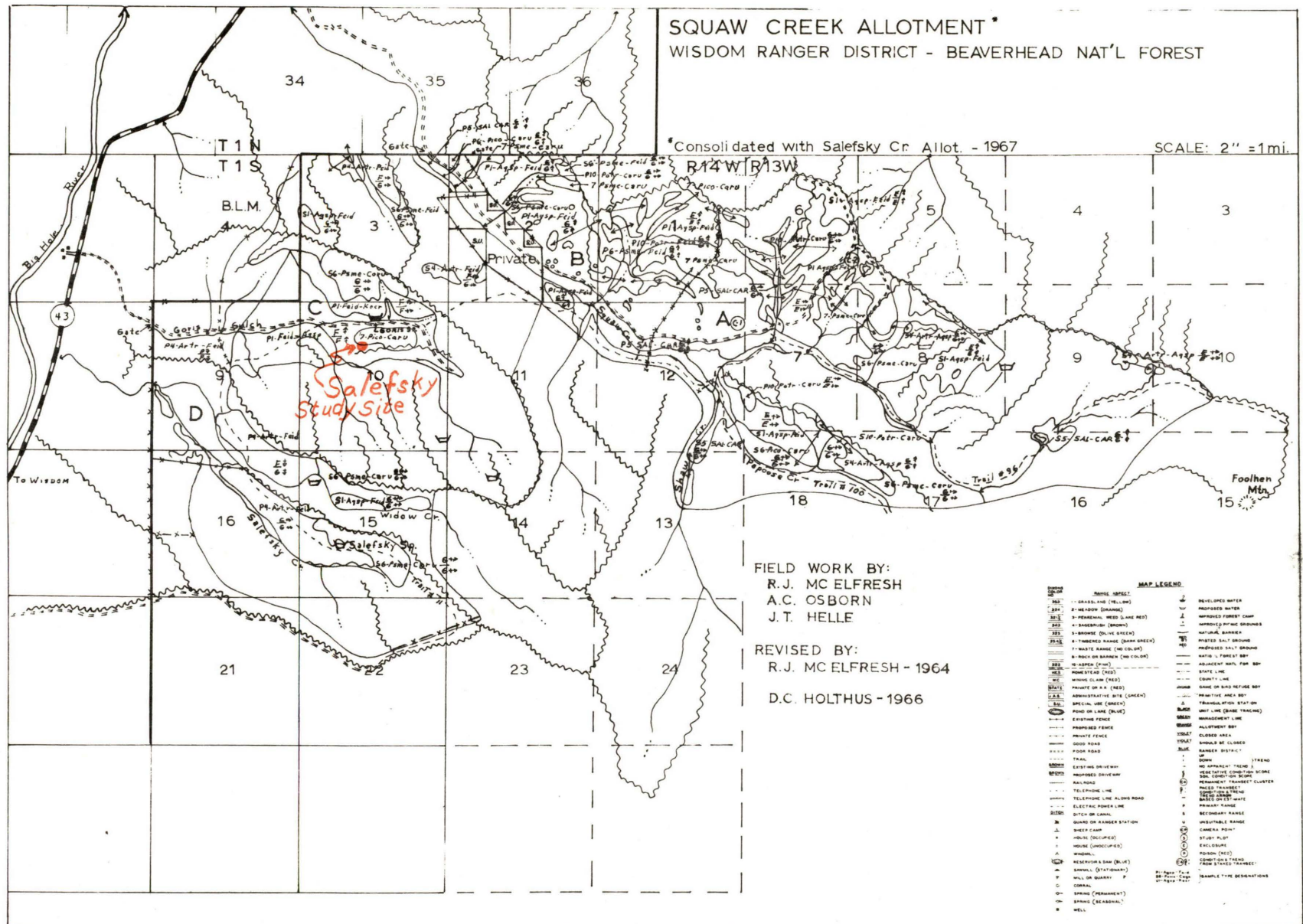
Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Agropyron spicatum	.3	1	.8	4
Agropyron sp.	.1			
Bromus inermis	.3	1	.4	2
B. marginatus	.3	1	.3	2
Carex spp.	.5	2	1.0	6
Festuca idahoensis	2.3	11	5.1	28
Melica bulbosa	.4	2	.8	4
Phleum alpinum	T		.2	1
Poa sp.	.1		.8	4
Stipa comata	.3	1	.7	4
TOTAL GRASSES AND SEDGES	4.6	22	10.1	56
Achillea millefolium	.3	1	.6	3
Agoseris glauca	.2	1	T	
Allium sp.	T			
Anaphalis margaritacea	.4	2	.2	1
Antennaria rosea	.7	3	.5	3
Arabis holboellii	T		T	
A. nuttallii	T		T	
Arenaria congesta	T		.1	
Arnica fulgens	.1		T	
A. sororia			.1	
Cerastium nutans	.3	1	.1	
Cirsium vulgare			T	
Claytonia lanceolata	.2	1	.1	
Clematis hirsutissima	.2	1	.1	
Collinsia parviflora	.2	1	T	
Collomia linearis	T		T	
Cruciferae sp.			T	
Delphinium bicolor	T		T	
Dodecatheon jeffreyi	.3	1	.6	3
Erigeron alpinus	.7	3	.3	2
Erythronium grandiflorum	.3	1	.1	
Fragaria virginiana	1.1	5	.5	3
Fritillaria atropurpurea			T	
Geranium viscosissimum	2.3	11	.7	4
Geum triflorum	1.5	7	.5	3
Helianthella uniflora	T			
Hieracium scouleri	T			
Hydrophyllum capitatum	T			
Lappula redowskii	.2	1	.1	
Linum perenne	.1			
Lithophragma parviflora	.3	1	.1	

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Species	UNSPRAYED		SPRAYED	
	Ave. sq dm	Percent of	Ave. sq dm	Percent of
	per 20 sq dm	total veg.	per 20 sq dm	total veg.
	plot	cover	plot	cover
		%		%
Lomatium triternatum	.3	1	.1	
Lupinus spp.	.1		.1	
Mertensia alpina	.1		T	
Orobanche uniflora			T	
Phlox kelseyi	.2	1	.9	5
Potentilla arguta	.8	4	.1	
P. gracilis	2.2	10	.3	2
Ranunculus glaberrimus	.3	1	.4	2
Rumex paucifolius	.1		T	
Senecio canus	.3	1	.2	1
S. lugens			.2	1
Taraxacum laevigatum	.1		.1	
Viola nuttallii	.3	1	.5	3
Wyethia helianthoides	.1			
Zygadenus venenosus	T		T	
(Total forb traces)	(.2)	(1)	(.2)	(1)
TOTAL FORBS	14.5	69	7.8	44
Artemisia tridentata	1.8	9	T	
TOTAL SHRUBS	1.8	9	T	
Bare ground	2.3		.7	

* Consolidated with Salefsky Cr. Allot. - 1967

$$\{ R_{14}W | R_{13}W \}$$


SALEFSKY CREEK

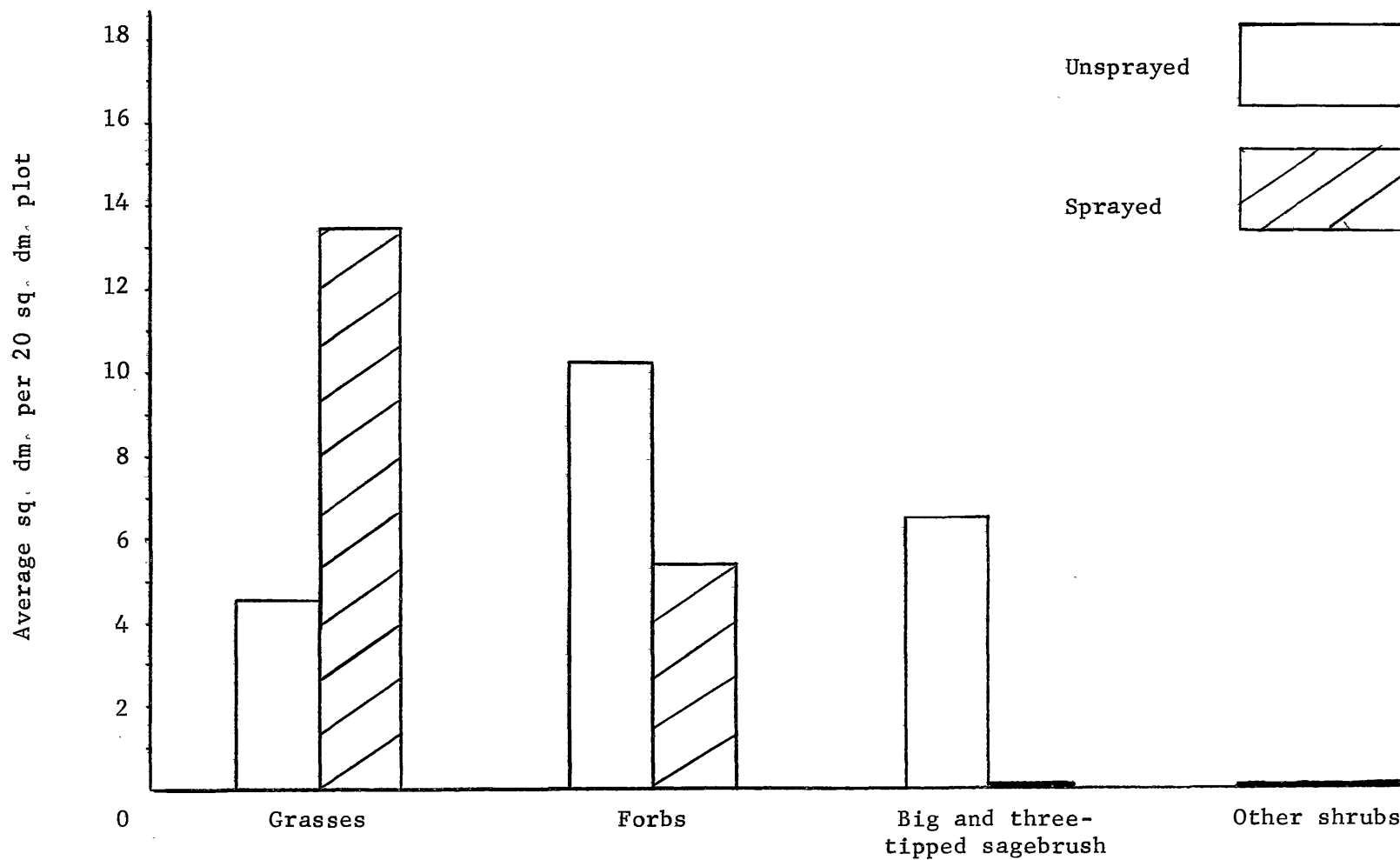
Location: S10 T1S R14W

Soil: Sandy loam (pH 6.25)
overlying gravelly to stony
sandy loam.

Sprayed: 1970

Sampled: June 22-23, 1972

Cover data for vegetation groupings on unsprayed and sprayed vegetation at Salefsky Creek. Sprayed 1970. Sampled June 22-23, 1972.



Cover data for Salefsky Creek, comparing unsprayed and sprayed (1970) vegetation. Sampled June 22-23, 1972.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Agropyron spicatum	.4	2	.2	1
Carex spp.	1.1	5	1.3	7
Danthonia unispicata	.1		T	
Festuca idahoensis	1.8	8	6.0	32
Koeleria cristata	.2	1	2.1	11
Poa sp.	.4	2	2.3	12
Stipa comata	.6	3	1.5	8
TOTAL GRASSES AND SEDGES	4.6	21	13.4	71
Achillea millefolium	.5	2	.9	5
Agoseris glauca	.1			
Anaphalis margaritacea	.5	2	T	
Anemone cernua	T			
Antennaria rosea	.2	1	.1	
Arabis holboellii	T			
A. nuttallii	.1			
Arenaria congesta	1.4	6	1.3	7
Arnica fulgens	.3	1	.2	1
Astragalus sp.	.2	1	T	
Besseyia wyomingensis	.1		.3	2
Castilleja flava	.2	1		
Collinsia parviflora	T		T	
Collomia linearis	T			
Comandra umbellata	T			
Delphinium bicolor	T			
Dodecatheon conjugens	.4	2	.1	
Erigeron alpinus	.1		.4	2
Frasera speciosa	.6	3	T	
Fritillaria atropurpurea	1.0	5	.1	
Geranium viscosissimum	.5	2	.1	
Geum triflorum	.9	4		
Heuchera parviflora	T			
Hieracium scouleri			T	
Lomatium triternatum	.1		T	
Lupinus sericeus	1.5	7	1.4	7
Mertensia alpina	.1			
Microseris nutans	.1			
Penstemon aridus	.7	3	T	
Phlox longifolia	.1		T	
Potentilla gracilis	.1			
Rumex paucifolius	T			
Sedum stenopetalum			T	
Senecio canus	.1			

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Species	UNSPRAYED		SPRAYED	
	Ave. sq dm	Percent of	Ave. sq dm	Percent of
	per 20 sq dm	total veg.	per 20 sq dm	total veg.
	plot	cover	plot	cover
		%		%
Taraxacum laevigatum	.1		.1	
Trifolium repens			T	
Viola nuttallii	.1		.3	2
(Total forb traces)	(.1)		(.1)	
TOTAL FORBS	10.2	48	5.4	29
Artemisia tridentata	6.5	30	T	
Chrysothamnus nauseosus	T			
Gutierrezia sarothrae			T	
Potentilla fruticosa	T			
Rosa woodsii	T		T	
TOTAL SHRUBS	6.6	30	T	



WEST FORK

SITE NO. 1

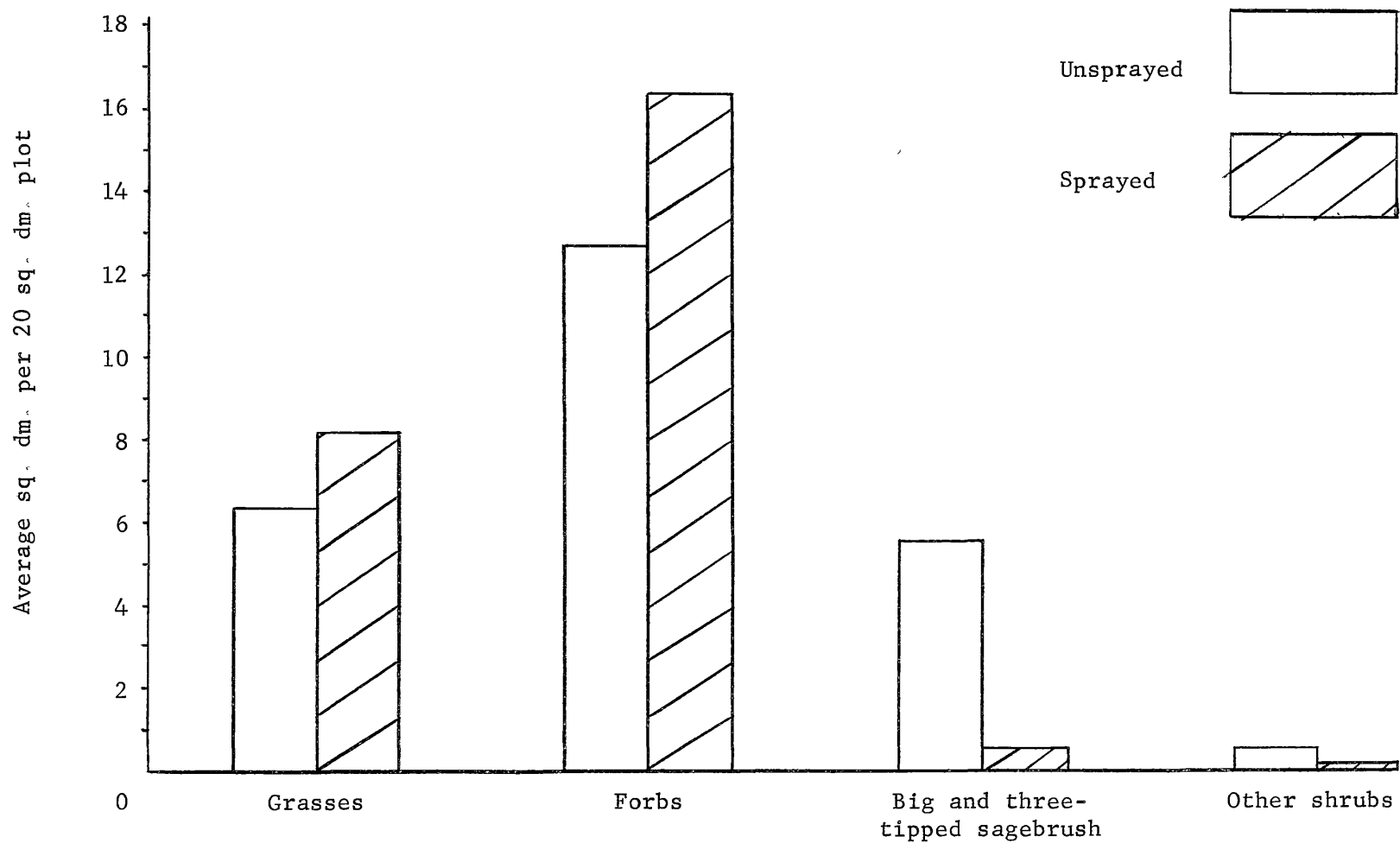
Location: S24 T12S R3W

Soil: Silty clay, with some gravel,
overlying hard clay at 10
inches.

Sprayed: 1959

Sampled: July 11-12, 1972

Cover data for vegetation groupings on unsprayed and sprayed vegetation at Westfork, Site 1. Sprayed 1959. Sampled July 11-12, 1972.



Cover data for Westfork, Site 1, comparing unsprayed and sprayed
(1959) vegetation. Sampled July 11-12, 1972.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
<i>Agropyron spicatum</i>	.6	2	1.9	7
<i>Bromus marginatus</i>	1.4	5	3.1	12
<i>Carex</i> spp.	1.1	4	.9	3
<i>Festuca idahoensis</i>	.4	2	.3	1
<i>Koeleria cristata</i>	T			
<i>Melica bulbosa</i>	.3	1	.1	
<i>Poa</i> sp.	1.6	6	1.2	5
<i>Stipa comata</i>	.9	4	.7	3
TOTAL GRASSES AND SEDGES	6.3	25	8.2	32
<i>Achillea millefolium</i>	.5	2	.3	1
<i>Agoseris glauca</i>	.4	2	1.5	6
<i>Antennaria rosea</i>	T		T	
<i>Arabis holboellii</i>			T	
<i>Arnica cordifolia</i>	.1			
<i>A. fulgens</i>			T	
<i>Astragalus miser</i>	T			
<i>Cerastium nutans</i>	.2	1	T	
<i>Cirsium vulgare</i>			.1	
<i>Clematis hirsutissima</i>	T			
<i>Collinsia parviflora</i>			.2	1
<i>Collomia linearis</i>	.6	2	1.2	5
<i>Galium boreale</i>	.5	2	.7	3
<i>Geranium viscosissimum</i>	3.3	13	5.1	20
<i>Geum triflorum</i>	T			
<i>Helianthus annuus</i>	.2	1	T	
<i>Lappula redowskii</i>	1.4	5	2.8	11
<i>Lomatium triternatum</i>	T		T	
<i>Lupinus</i> spp.	.8	3	.3	1
<i>Mertensia oblongifolia</i>			T	
<i>Osmorhiza occidentalis</i>	T			
<i>Penstemon aridus</i>			T	
<i>Phacelia heterophylla</i>	T		.4	2
<i>Phlox longifolia</i>	.1		.1	
<i>Polygonum aviculare</i>	.1		.1	
<i>Potentilla arguta</i>	.1			
<i>P. gracilis</i>	1.0	4	1.3	5
<i>Rumex paucifolius</i>			T	
<i>Smilacina stellata</i>	1.0	4	.5	2
<i>Thalictrum occidentale</i>			1.3	5
<i>T. sparsiflorum</i>	1.7	7		
<i>Viola nuttallii</i>	T		.1	
<i>Wyethia amplexicaulis</i>	.3	1		

Continued on next page.

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Species	UNSPRAYED		SPRAYED	
	Ave. sq dm	Percent of	Ave. sq dm	Percent of
	per 20 sq dm	total veg.	per 20 sq dm	total veg.
	plot	cover	plot	cover
		%		%
Unidentified species	.2	1		
(Total forb traces)	(.2)	(1)	(.3)	(1)
TOTAL FORBS	12.7	50	16.3	64
Artemisia tridentata	5.6	22	.6	2
Symphoricarpos albus	.6	2	.2	1
TOTAL SHRUBS	6.2	25	.8	3
Bare ground	.1		.6	

WEST FORK

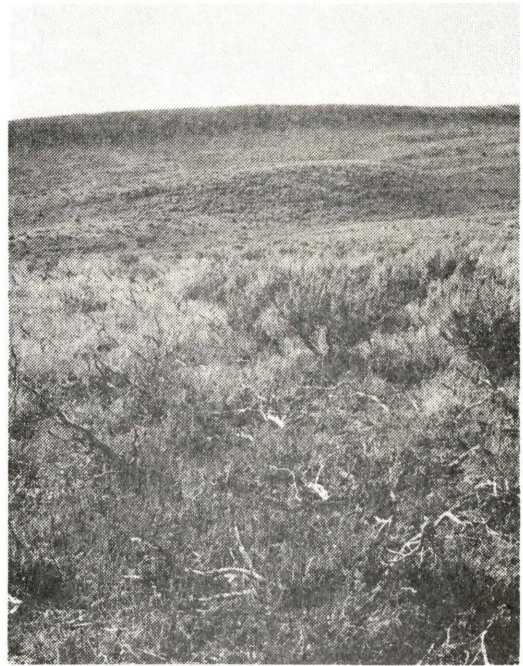
SITE NO. 2

Location: S19 T12S R2W

Soil: Silty clay, with some
gravel and stones, over-
lying stony clay at 8
inches.

Sprayed: 1959

Sampled: July 10-11, 1972



General view

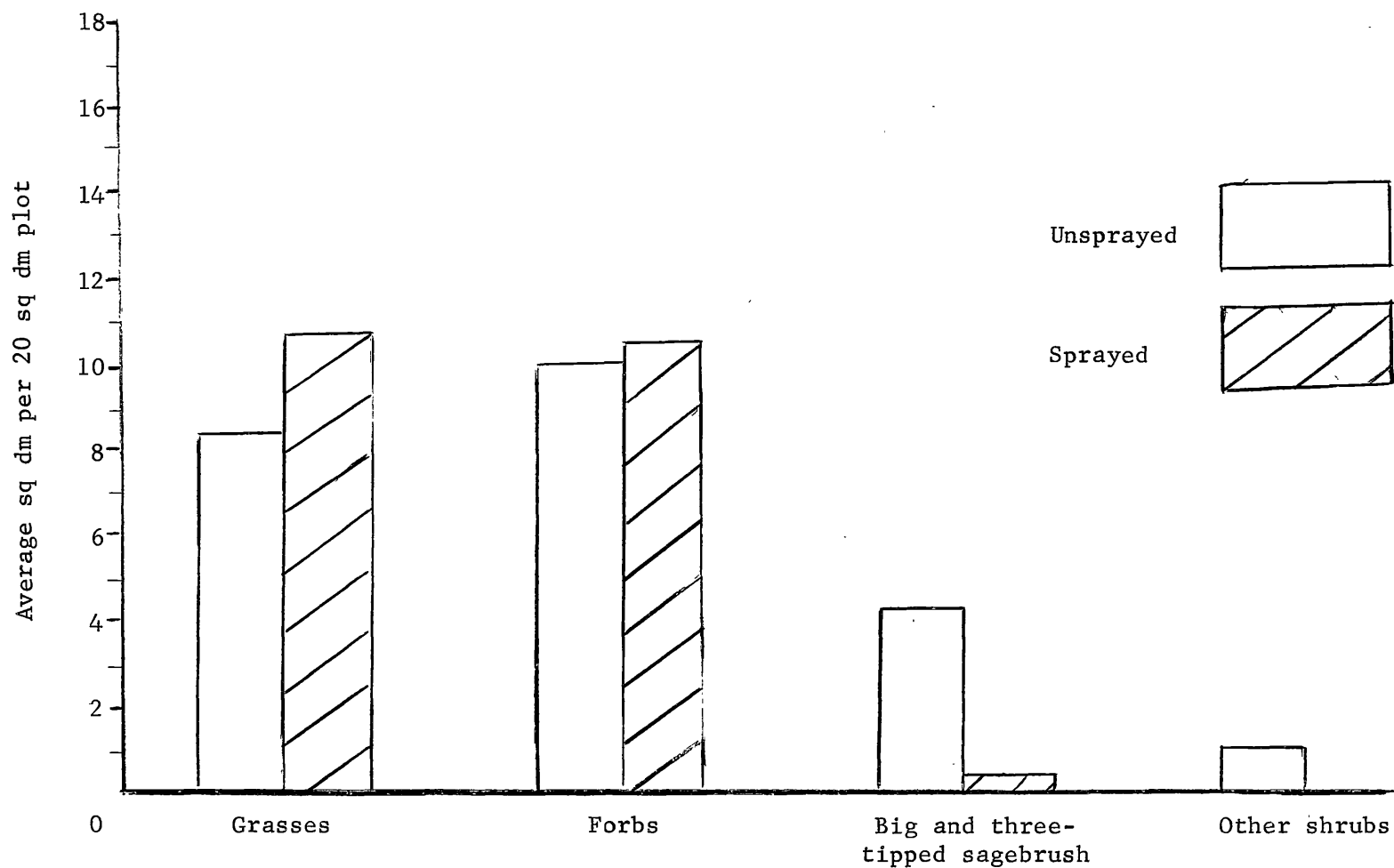


Unsprayed



Sprayed

Cover data for vegetation groupings on unsprayed and sprayed vegetation at Westfork, Site 2. Sprayed 1959. Sampled July 10-11, 1972.



Cover data for Westfork, Site 2, comparing unsprayed and sprayed
(1959) vegetation. Sampled July 10-11, 1972.

Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Agropyron spicatum	3.4	14	4.7	22
Bromus marginatus	.5	2	.8	4
Carex spp.	.4	2	.6	3
Danthonia unispicata			T	
Deschampsia caespitosa	.1		T	
Festuca idahoensis	2.8	12	3.2	15
Koeleria cristata			.1	
Melica bulbosa			T	
Poa sp.	.6	2	.7	3
Stipa comata	.8	3	.7	3
TOTAL GRASSES AND SEDGES	8.6	35	10.8	50
Achillea millefolium	2.1	9	2.5	11
Agoseris glauca	1.9	8	2.5	11
Antennaria rosea	.1		.1	
Arabis holboellii	T		T	
Arenaria congesta	T		.1	
Cerastium nutans	T		.1	
Cirsium vulgare			T	
Collomia linearis	.8	3	1.1	5
Draba nemorosa	T			
Erigeron alpinus	.8	3	.4	2
Geranium viscosissimum	T		T	
Geum triflorum	.3	1	.4	2
Lactuca sp.			T	
Lappula redowskii	.1		.1	
Linum perenne	.1		.1	
Lomatium triternatum	.1		T	
Lupinus spp.	.8	3	.2	1
Mertensia longifolia	T		.1	
M. oblongifolia	T		T	
Microseris nutans	.1		T	
Penstemon aridus	.2	1	.1	
Phacelia heterophylla	T			
Phlox kelseyi	.3	1	.3	1
P. longifolia	T		T	
Polygonum viviparum	.1			
Potentilla gracilis	.9	4	1.1	5
Ranunculus glaberrimus	T		T	
Rumex paucifolius	.1		.2	1
Senecio integerrimus	.1		.2	1
Sophia filipes	T			
Taraxacum laevigatum	.2	1	.3	1

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Species	UNSPRAYED		SPRAYED	
	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %	Ave. sq dm per 20 sq dm plot	Percent of total veg. cover %
Trifolium repens	.2	1		
Viola nuttallii	.2	1	.2	1
Wyethia amplexicaulis	.5	2	.2	1
Unidentified species	.1			
(Total forb traces)	(.2)	(1)	(.3)	(1)
TOTAL FORBS	10.3	43	10.6	49
Artemisia ludoviciana			T	
A. tridentata	4.4	18	.3	1
Tetradymia canescens	.9	4		
TOTAL SHRUBS	5.3	22	.3	1
Bare ground	.2		.1	

SUPPLEMENTAL INFORMATION

to

ADMINISTRATIVE STUDY

The effect of 2,4-D on sagebrush and associated
vegetation on the Beaverhead National Forest, Montana

Compiled by:

Henry E. Greitl
Range Specialist

Beaverhead National Forest

Antelope Basin #670

1. Spray Data

a. Chemical and Carrier

2,4-D and diesel fuel.

b. Concentration

2,4-D Iso-Octyl ester with six pound acid equivalent per gallon.

c. Rate of Application

3 gallon of spray mix per acre made up of 2 2/3 gallon of diesel and 1/3 gallon of 2,4-D.

d. Date and Growth Stage at Time of Spray

Sprayed June 24 - 25, 1970.

Vegetation in active growing stage, early forbs in bloom and early grasses starting to head out.

e. Cost - \$4.81 per acre.

2. Site Data

a. Plant association (prior to spraying)

Mixed bunch grasses and forbs with an overstory of sagebrush.

b. Range Condition (prior to spraying)

Range condition was classified good with downward trend due to the heavy sagebrush overstory.

c. Weather - (climate)

The area lies within the 14" to 20" annual precipitation zone with much of the moisture coming in the form of snow.

3. Management Information

a. Class of Stock - Cattle

b. Treatment After Spraying

Area rested for two growing seasons before being sprayed. This allowed the grasses to regain vigor and allow new seedlings to become established.

c. Grazing System Used

a. Four pasture rest-rotation system with one pasture rested each year. System working good.

1. Spray Data

a. Chemical and Carrier

2,4-D and diesel fuel

b. Concentration

2,4-D low volatile Iso-Octyl ester containing 6 pound acid equivalent per gallon.

c. Rate of Application

Three gallons of spray mix per acre made up of 2 2/3 gallons of diesel fuel and 1/3 gallon of 2,4-D.

d. Date and Growth Stage at Time of Spray

Sprayed on June 12, 13, 14 and 15, 1963 - weather during this project was rainy, cold and windy which probably accounts for the poor kill on sagebrush seedlings and young protected sagebrush plants.

Vegetation was in active growth stage.

e. Cost - \$3.34 per acre

2. Site Data

a. Plant Association (prior to spraying)

Mixed bunch grasses and forbs with an overstory of sagebrush.

b. Range Condition (prior to treatment)

Range condition was classified as fair and good throughout the treatment area.

c. Weather (climate)

The area receives approximately 20" of annual precipitation with much of it coming in the form of snow. High winds during winter in this open country create large snowdrifts on the lee side of the hills near the crest.

3. Management Information

a. Class of Stock - Cattle

b. Treatment After Spraying

Area rested for two growing seasons before being grazed. This allowed grasses to regain vigor and new seedlings to become established.

c. Grazing System Used

A four pasture rest-rotation was set up with one pasture being completely rested each year. It has not been possible to follow this plan exactly every year due to water shortages on portions of the allotment.

1. Spray Data

a. Chemical and Carrier

2,4-D and diesel fuel.

b. Concentration

2,4-D low volatile Iso-Octyl ester containing six pound acid equivalent per gallon.

c. Rate of Application

Three gallons of spray mix per acre made up of 2 2/3 gallons of diesel fuel and 1/3 gallon of 2,4-D.

d. Date and Growth Stage at Time of Spray

This area was divided into two spray projects, one project was sprayed on June 12 - 20, 1965. Inclement weather caused this project to drag out for nine days. The second project was sprayed June 20 - 22, 1970.

On the first project the vegetation was just starting active growth - shooting star in flower.

On the second project the vegetation was well into active growth stage.

e. Cost

First project averaged \$5.34 per acre and second project averaged \$4.81 per acre.

2. Site Data

a. Plant Association (prior to spraying)

Mixed bunch grasses and forbs with an overstory of sagebrush.

b. Range Condition (prior to spraying)

Range condition was classified as fair and good throughout the treatment area.

c. Weather (climate)

The treatment areas lie within the 15" - 25" annual precipitation zone with much of the moisture coming in the form of snow.

3. Management Information

a. Class of Stock - Cattle

b. Treatment after Spraying

Each treatment area was rested two growing seasons after spraying. This allowed the grasses to regain vigor and new seedlings to become established.

c. Grazing System Used

These treatment areas are a portion of a large cattle allotment. In 1970 the allotment started using a six pasture rest-rotation management system of which two pastures are rested each year.

Cottonwood - Trail Creek #541

1. Spray Data

a. Chemical and Carrier

2,4-D and diesel fuel

b. Concentration

2,4-D low volatile ester containing six pound acid equivalent per gallon.

c. Rate of Application

Three gallons of spray mix per acre containing 2 2/3 gallons of diesel fuel and 1/3 gallon of 2,4-D.

d. Date and Growth Stage at Time of Spraying

The area was sprayed June 16, 17, and 18, 1961. Vegetation was in active growing stage with early forbs in bloom and early grasses starting to head out.

e. Cost - \$4.33 per acre.

2. Site Data

a. Plant Association (prior to spraying)

Mixed bunch grasses and forbs with an overstory of sagebrush.

b. Range Condition (prior to spraying)

The area was classified in fair and good condition.

c. Weather (climate)

The area lies within the 14" - 20" annual precipitation zone with much of the moisture coming in the form of snow.

3. Management Information

a. Class of Stock - Cattle

b. Treatment After Spraying

The area was rested for two years after it was sprayed.

c. Grazing System Used

A four pasture rest-rotation system with each pasture receiving total rest every fourth year. The system was started in 1963.

Coyote Creek #632

1. Spray Data

a. Chemical and Carrier

2,4-D and diesel fuel.

b. Concentration

2,4-D low volatile Iso-Octyl ester containing 6 pound acid equivalent per gallon.

c. Rate of Application

Three gallons of spray mix per acre made up of 2 2/3 gallons of diesel fuel and 1/3 gallon of 2,4-D.

d. Date and Growth Stage at Time of Spray

The area was sprayed on June 16 & 17, 1970. Vegetation was in active growing stage with early forbs in bloom and early grasses starting to head out.

e. Cost - \$4.81 per acre.

2. Site Data

a. Plant Association (prior to spraying)

Mixed bunch grasses and forbs with an overstory of sagebrush.

b. Range Condition (prior to spraying)

The area was classified in fair and good condition.

c. Weather (climate)

The area lies within the 14" to 20" annual precipitation zone with much of the moisture coming in the form of snow.

3. Management Information

a. Class of Stock - Cattle

b. Treatment after Spraying

The area was rested for two growing seasons after spraying to allow the grasses to regain vigor and new seedlings to become established.

c. Grazing System Used

The area is being grazed under a four pasture, rest-rotation system with one pasture being rested each year. The system is working good.

Doolittle Creek #537

1. Spray Data

a. Chemical and Carrier

2,4-D and diesel fuel.

b. Concentration

2,4-D ester containing 6 pound acid equivalent per gallon.

c. Rate of Application

Three gallons of spray mix per acre made up of 2 2/3 gallons of diesel fuel and 1/3 gallon of 2,4-D.

d. Date and Growth Stage at Time of Spray

The area was sprayed on July 8 and 9, 1959. This project was among the first year helicopter spray projects on the Beaverhead National Forest and one of the last projects sprayed that year. There are no records of growth stage during spraying, however, from our experience, growth must have been pretty well advanced and slowing down.

e. Cost

\$5.01 per acre (including some protective fencing).

2. Site Data

a. Plant Association (prior to spraying)

Mixed bunch grass and forbs with an overstory of sagebrush.

b. Range Condition (prior to treatment)

The area was classified in fair and good condition.

c. Weather (Climate)

The area lies within the 14" to 20" annual precipitation zone with much of the moisture coming in the form of snow.

3. Management Information

a. Class of Stock - Cattle

b. Treatment After Spraying

The area was rested for three growing seasons after spraying to allow the grasses to regain vigor and new seedlings to become established.

c. Grazing System Used

In 1962 and 1963 the area was grazed in a deferred rotation system.

In 1964 another allotment was combined with this area and a three pasture rest-rotation system was set up with two early pastures and one fall pasture.

Each of the early pastures receive complete rest every other year. The fall pasture is used last every year.

1. Spray Data

a. Chemical and Carrier

2,4-D and diesel fuel.

b. Concentration

2,4-D low volatile Iso-Octyl ester containing 6 pound acid equivalent per gallon.

c. Rate of Application

Three gallons of spray mix per acre made up of 2 2/3 gallons of diesel fuel and 1/3 gallon of 2,4-D.

d. Date and Growth Stage at Time of Spray

The area was sprayed on June 15 - 17, 1966. Vegetation was in active growing stage with early forbs in bloom and early grasses starting to head out.

e. Cost - \$5.56 per acre.

2. Site Data

a. Plant Association (prior to spraying)

Mixed bunch grasses and forbs with an overstory of sagebrush.

b. Range Condition (prior to spraying)

The area was classified in fair and good condition.

c. Weather (climate)

The area lies within the 20" to 30" annual precipitation zone with much of the moisture coming in the form of snow.

3. Management Information

a. Class of Stock - Cattle

b. Treatment After Spraying

The area was rested for two growing seasons after spraying to allow grasses to regain vigor and new seedlings to become established.

c. Grazing System Used

The area was grazed 1969 by a deferred system and in 1970 a four pasture rest-rotation system was initiated with one pasture being rested each year. There is a problem in one pasture with larkspur poisoning so the present system may have to be modified so that the poison pasture is used last each year and the rest rotated between the other three pastures.

Headquarters & Corral Creek #632

1. Spray Data

a. Chemical and Carrier

2,4-D and diesel fuel.

b. Concentration

2,4-D low volatile Iso-Octyl ester containing 6 pound acid equivalent per gallon.

c. Rate of Application

Three gallons of spray mix made up of 2 2/3 gallons of diesel fuel and 1/3 gallon of 2,4-D.

d. Date and Growth Stage at Time of Spray

The area was sprayed on June 19 - 22, 1967. Vegetation in active growing stage with the early forbs in bloom and early grasses starting to head out.

e. Cost - \$4.29 per acre.

2. Site Data

a. Plant Association (prior to spraying)

Mixed bunch grasses and forbs with an overstory of sagebrush.

b. Range Condition (prior to spraying)

The entire area was classified in good condition.

c. Weather (climate)

The area lies within the 14" to 20" annual precipitation zone with much of the moisture coming in the form of snow.

3. Management Information

a. Class of stock

Cattle

b. Treatment After Spraying

The area was rested for two growing seasons after spraying to allow the grasses to regain vigor and new seedlings to become established.

2.

c. Grazing System Used

The treatment area is a portion of a large cattle allotment. In 1970 a six pasture rest-rotation management system was initiated with two pastures being rested each year.

1. Spray Data

a. Chemical and Carrier

2,4-D and diesel fuel.

b. Concentration

2,4-D low volatile Iso-Octyl ester containing 6 pound acid equivalent per gallon.

c. Rate of Application

Three gallons of spray mix per acre made up of 2 2/3 gallons of diesel fuel and 1/3 gallon of 2,4-D.

d. Date and Growth Stage at Time of Spray

The area was sprayed on June 18 and 19, 1970. The vegetation was in active growing stage with early forbs in bloom and early grasses starting to head out.

e. Cost - \$4.81 per acre.

2. Site Data

a. Plant Association (prior to spraying)

Mixed bunch grasses and forbs with an overstory of sagebrush.

b. Range Condition (prior to spraying)

The area was classified as fair condition.

c. Weather (Climate)

The area lies within the 14" to 20" annual precipitation zone with much of the moisture coming in the form of snow.

3. Management Information

a. Class of Stock - Cattle

b. Treatment After Spraying

The area was rested in 1969 prior to spraying and also the year it was sprayed and the year after. So actually the area had three consecutive years of non-use.

c. Grazing System Used

The area is one pasture of an eight pasture rest-rotation management system and each pasture receives complete rest one year in every four.

1. Spray Data

a. Chemical and Carrier

2,4-D and diesel fuel

b. Concentration

2,4-D ester containing 6 pound acid equivalent per gallon.

c. Rate of Application

Three gallons of spray mix per acre made up of 2 2/3 gallons of diesel fuel and 1/3 gallon of 2,4-D.

d. Date and Growth Stage at Time of Spray

The area was sprayed on June 23 - 28, 1960. Vegetation was in active growing stage with early forbs in bloom and early grasses were headed out.

e. Cost

\$5.98 per acre which includes the fencing materials cost.

2. Site Data

a. Plant Association (prior to spraying)

Mixed bunch grasses and forbs with an overstory of sagebrush.

b. Range Condition (prior to spraying)

The area was classified in good condition.

c. Weather (climate)

The area lies within the 20" to 30" annual precipitation zone with much of the moisture coming in the form of snow.

3. Management Information

a. Class of Stock

Sheep up through 1965, converted to cattle in 1966.

b. Treatment After Spraying

The area was rested in 1960 and 1961 to allow grasses to restore vigor and seedling establishment after the sagebrush was controlled.

c. Grazing System Used

From 1962 through 1965 the area was grazed by sheep by the camp unit system - once over the allotment each season. In 1966 the area was converted to cattle and cross fenced and a four pasture rest-rotation system was initiated with one pasture being rested each year. This is a very good allotment and system is working good.

1. Spray Data

a. Chemical and Carrier

2,4-D and diesel fuel.

b. Concentration

2,4-D low volatile Iso-Octyl ester containing 6 pound acid equivalent per gallon.

c. Rate of Application

Three gallons of spray mix per acre made up of 2 2/3 gallons of diesel fuel and 1/3 gallon of 2,4-D.

d. Date and Growth Stage at Time of Spray

The area was sprayed on June 15 and 16, 1968. Vegetation was in active growing stage with early forbs in bloom and early grasses starting to head out.

e. Cost

\$5.85 per acre.

2. Site Data (prior to spraying)

a. Plant Association

Mixed bunch grasses and forbs with an overstory of sagebrush.

b. Range Condition (prior to spraying)

The area was classified in fair and good condition.

c. Weather (climate)

The area lies within the 20" to 30" annual precipitation zone with much of the moisture coming in the form of snow.

3. Management Information

a. Class of Stock - Cattle

b. Treatment after Spraying

The area was rested for two years to allow grasses to regain vigor and seedling establishment.

2.

c. Grazing System Used

A four pasture, rest-rotation system was initiated following the spray project with one pasture being rested every year.

1. Spray Data

a. Chemical and Carrier

2,4-D and diesel fuel.

b. Concentration

2,4-D low volatile Iso-Octyl ester containing six pound acid equivalent per gallon.

c. Rate of Application

Three gallons of spray mix per acre made up of 2 2/3 gallons of diesel fuel and 1/3 gallon of 2,4-D.

d. Date and Growth Stage at Time of Spraying

The area was sprayed on June 23 and 24, 1970. Vegetation was in active growing stage with early forbs in bloom and early grasses headed out.

e. Cost - \$4.81 per acre.

2. Site Data

a. Plant Association (prior to spraying)

Mixed bunch grasses and forbs with an overstory of sagebrush.

b. Range Condition (prior to spraying)

The area was classified in fair and good condition.

c. Weather (climate)

The area lies within the 14" to 20" annual precipitation zone with much of the moisture coming in the form of snow.

3. Management Information

a. Class of Stock - Cattle

b. Treatment after Spraying

The area was rested the year it was sprayed and was grazed late the following year to get seed trampling.

c. Grazing System Used

A five pasture rest-rotation system is used with each pasture receiving total rest one year in every four years.

1. Spray Data

a. Chemical and Carrier

2,4-D and diesel fuel.

b. Concentration

2,4-D low volatile Iso-Octyl ester containing six pound acid equivalent per gallon.

c. Rate of Application

Three gallons of spray mix per acre made up of 2 2/3 gallons of diesel fuel and 1/3 gallon of 2,4-D.

d. Date and Growth Stage at Time of Spraying

The area was sprayed on June 10 and 11, 1970. Vegetation was in active growing stage with early forbs in bloom and early grasses starting to head out.

e. Cost - \$4.81 per acre.

2. Site Data

a. Plant Association (prior to spraying)

Mixed bunch grasses and forbs with an overstory of sagebrush.

b. Range Condition (prior to spraying)

The area was classified in fair and good condition.

c. Weather (climate)

The area lies within the 10" to 14" annual precipitation zone with much of the moisture coming in the form of snow.

3. Management Information

a. Class of Stock - Cattle

b. Treatment after Spraying

The area was rested the year it was sprayed and was grazed late the following year to get seed trampling.

c. Grazing System Used

The area is an early pasture in a three pasture grazing system and is rested every other year.

1. Spray Data

a. Chemical and Carrier

2,4-D and diesel fuel.

b. Concentration

2,4-D ester containing six pound acid equivalent per gallon.

c. Rate of Application

Three gallons of spray mix per acre containing $2 \frac{2}{3}$ gallons of diesel fuel and $\frac{1}{3}$ gallon of 2,4-D.

d. Date and growth Stage at Time of Spraying

The area was sprayed from June 15 to July 6, 1959. At the start of the project, vegetation was actively growing and the wyethia was just starting to bloom. By the time the project was completed, the growth on the sagebrush was slowing down and the wyethia was past the full bloom stage.

e. Cost - \$5.00 per acre.

2. Site Data

a. Plant Association (prior to spraying)

Mixed bunch grasses and forbs with an overstory of sagebrush and some areas containing a heavy stand of wyethia.

b. Range Condition (prior to spraying)

The area was classified in poor to good condition. The poor condition range was the areas infested with wyethia.

c. Weather (climate)

The area lies within the 14" to 20" annual precipitation zone with much of the moisture coming in the form of snow.

3. Management Information

a. Class of Stock - Sheep.

b. Treatment After Spraying

The area was subjected to very light grazing for three years after spraying and then went back to regular stocking in 1962.

2.

c. Grazing System Used

The area is being grazed using a deferred rotation system of management.